

Draft
General Management Plan/Development Concept Plan
Environmental Impact Statement



PETROGLYPH

National Monument • New Mexico

Aerial photo of Rinconada Canyon and Mesa Prieta with volcanoes and Mt. Taylor in the background by Lee B. Morgan of Eagle's Eye Photo Specialists (reprinted by permission)



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August 1995

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DRAFT
GENERAL MANAGEMENT PLAN
DEVELOPMENT CONCEPT PLAN
ENVIRONMENTAL IMPACT STATEMENT

PETROGLYPH NATIONAL MONUMENT
Bernalillo County, New Mexico

United States Department of the Interior, National Park Service
in cooperation with
City of Albuquerque • State of New Mexico • Federal Aviation Administration

Four alternatives for future management and use of the newly established Petroglyph National Monument are analyzed in this document. Development actions under all alternatives are based on establishing a strong managing agency presence to preserve the resources. The overall approach of alternative 1, the proposed action and preferred alternative, is to provide diverse opportunities for visitors of different ages and abilities to see petroglyphs within the context of the escarpment, mesa top, volcanoes, Rio Grande valley, and Sandia Mountains. Visitors would be directed to a visitor center/heritage education center at Boca Negra Canyon. Horseback and bicycle riding would be permitted on selected designated mesa-top trails and at three crossing points. No horses or bicycles would be allowed in petroglyph viewing areas or archeological sites anywhere in the monument. Mesa-top resources and visitor experiences would be monitored to identify adverse impacts. Impacts on natural and cultural resources, the regional economy, visitors, and values held by culturally affiliated groups would be minimal or, in some cases, beneficial. Mitigating measures would be developed to avoid significant adverse effects on the ferruginous hawk, which is being considered for listing by the U.S. Fish and Wildlife Service as a threatened species, and for the two rare cactus species. The overall approach of alternative 2 is that less development and therefore less use would provide greater protection for monument resources. This alternative would preserve the greatest portion of the monument and adjacent lands in as natural a condition as possible with the fewest intrusions from development and fewer opportunities for easy public access and use. Visitors would be directed to a visitor center in Lava Shadows where they would have access to selected petroglyphs. A heritage education center would be built at Boca Negra Canyon. Visitors would have more opportunities to see the petroglyphs with a greater sense of solitude than in alternative 1. More areas of the monument would be reserved for research, American Indian use, and occasional guided tours than in the other alternatives. Horse and bicycle use would not be permitted in this alternative except at two escarpment crossings. Overall, adverse impacts on cultural and natural resources and values held by culturally affiliated groups would be similar to and in some cases slightly less under this alternative than alternative 1. As in alternative 1, mitigation measures would avoid significant impacts on the ferruginous hawk, which is being considered for listing by the U.S. Fish and Wildlife Service as a threatened species, and for the two rare cactus species. The overall approach of alternative 3 is that visitors would have easy access to the mesa-top views and the volcanoes as well as petroglyph concentrations below the escarpment. Visitors would be directed to a visitor/heritage education center in Rinconada Canyon. From the visitor center many visitors would drive to a new 10-mile mesa-top loop road that would provide easy access to the mesa-top views and the volcanoes. Parking and trails would be developed at the volcanoes and geologic windows areas. Horse and bicycle use would be provided at three escarpment crossings. Developing the mesa-top road would adversely impact the cultural landscape, which is significant to the Pueblo community. There would be adverse impacts on natural drainage patterns and on visitors and residents from increased noise levels. This alternative would directly impact more archeological sites, would result in more negative cumulative impacts on cultural resources and values held by culturally affiliated groups, and would require more costly programs to mitigate than the other alternatives. The ferruginous hawk, being considered for listing, and for the two rare cactus species would be significantly adversely impacted under this alternative. Adverse impacts on scenic resources would also be greatest under this alternative. Alternative 4, a "no action" alternative, describes the conditions that would exist at the monument without a change in current management direction or an approved general management plan — providing a baseline for evaluating the changes and impacts that would occur under the three action alternatives. There would be parking areas and minor trail improvements in some areas. There would be no new visitor or heritage education center. This alternative would have the fewest facilities. Horseback and bicycle riding would be permitted within the monument only where currently allowed. The interim visitor center at Las Imagines would become the primary visitor center, accommodating only a limited number of visitors. Archeological sites, petroglyphs, and the cultural landscape would continue to be adversely impacted by vandalism. There would be no significant adverse impacts on the ferruginous hawk or the two rare cactus species. Most of the monument's natural scenic qualities would not be disturbed by developing new facilities.

Questions about this document should be addressed to Lawrence Beal, Chief of Planning, at the following address. The review period for this document ends November 6, 1995. All review comments must be received by that date.

Superintendent, Petroglyph National Monument
4735 Unser Boulevard NW
Albuquerque, NM 87120 (505) 839-4429

SUMMARY

Petroglyph National Monument is the first national park system area specifically established to protect and interpret petroglyphs and their setting for the benefit and enjoyment of present and future generations. This *Draft General Management Plan / Development Concept Plan / Environmental Impact Statement* for the newly established monument sets forth the basic management philosophy of the monument to preserve and protect monument resources and provide for visitor use. The monument would be managed to preserve the cultural and natural resources for the benefit and enjoyment of current and future generations. Federal laws that are generally applicable to units of the national park system also apply to the monument.

This document addresses the issues and concerns that were identified in meetings with concerned agencies, organizations, and individuals. The issues and concerns include partnership responsibilities, cultural and natural resource protection, how to protect the religious sites and values of the American Indian community, how to document traditional uses and address concerns of the heirs of the Atrisco land grant, as well as issues concerning interpretation, education, visitor circulation and access, public use of the monument, neighborhood interests, stormwater drainage and utility rights-of-way, and boundary adjustments. In addition, several issues were raised that were beyond the scope of this plan.

This document presents four alternatives, including a preferred alternative, for the development, resource management, and visitor use of the monument. The impacts of implementing the proposed action and the other three alternatives are addressed in the "Environmental Consequences"

section of the document. Because of the federal laws and policies that apply to managing the monument's resources, many resource management actions, including cultural landscape and archeological site values, natural resources, and various other aspects of monument management, are common to all four alternatives. The alternatives describe different visitor experiences and different kinds and locations for facilities under this common resource management approach. The following section describes the most significant of these common actions.

SUMMARY OF ACTIONS COMMON TO ALL ALTERNATIVES

Partnership, Jurisdiction, Responsibilities

The National Park Service would assume primary responsibility for cultural and natural resource management on a monumentwide basis and would be responsible for funding and operating the petroglyph research center. The city would assume primary responsibility for managing the Piedras Marcadas Pueblo ruin. The Park Service and the city Open Space Division would work with city and county Land Use Planning and Permitting Divisions to ensure the coordination of review for developing adjacent lands.

Cultural and Natural Resource Management

Cultural resources would be managed by implementing various policies, programs, and strategies, including education, continuing scientific study, inventory, evaluation, and consultation with American Indian groups and Atrisco land grant heirs.

Cultural resource management is comprised of several components including (1) inventorying, evaluating, and monitoring, (2) direct preservation, protection, maintenance, and stabilization actions, (3) protecting the cultural landscape, (4) research, (5) directing visitor use/designing and locating facilities, (6) law enforcement, and (7) educational and interpretive programs (including the heritage education program). The petroglyph research center/function would be an integral part of managing the cultural resources.

Cultural resources would be managed to provide the greatest degree of protection and preservation and to make all possible efforts to ensure that archeological resources would not be disturbed or removed. No petroglyphs would be relocated or repositioned.

Natural resource management programs and techniques would include (1) inventory and research (2) mitigation, (3) monitoring, (4) protection (5) interpretation and education, (6) administration, and (7) appropriate design of trails and facilities.

Directing Visitor Use / Designing and Locating Facilities

Visitors would be directed to sites and areas that can best accommodate use and would be discouraged or prohibited from areas where use would adversely impact or destroy sensitive natural or cultural resources. New facilities would be designed and sited to minimize direct impacts on petroglyphs and other potentially significant cultural and natural resources.

Activities in petroglyph concentration areas would be focused on opportunities for visitors to see the petroglyphs in their context and within the cultural landscape. Only the development necessary to

properly guide visitors and protect resources would be allowed. Sensitive design of new visitor facilities in petroglyph viewing areas would be of vital importance to prevent adverse impacts. Visitors would be required to stay on trails. Facility design would reflect cultural and natural values of the monument and have a common theme. Wherever possible, new roads and trails would follow existing routes to preserve the cultural landscape and prevent new disturbance of archeological and natural resources.

Law Enforcement

Law enforcement would be used to ensure compliance with monument regulations. Rangers would actively patrol the monument, with special attention to petroglyph and archeological sites.

American Indian Relationships, American Indian Religious Freedom Act, and Traditional Uses

All public lands within the monument would be managed to comply with the American Indian Religious Freedom Act and related NPS policies. In carrying out this mandate, all monument programs would reflect informed awareness, sensitivity, and serious concern for the traditions, cultural values, and religious beliefs of American Indians who have ancestral ties to the monument. Monument managers would work with Pueblo groups to minimize interference with traditional uses, consistent with the American Indian Religious Freedom Act.

The Park Service would involve American Indians in current and future interpretive programs. This involvement could range from developing the programs to reviewing materials to presenting programs.

Throughout and after the planning for this management plan, the Park Service and city representatives would continue to consult with American Indian groups regarding visitor use, archeological research, interpretive programs, and resource management for the monument.

Atrisco Land Grant Heirs

The Park Service would continue to work and consult with the Atrisco land grant heirs to determine and document the nature and extent of any such traditional uses and how to maintain opportunities for such uses to continue. Consultation with Atrisco land grant heirs would help avoid impacts on potential traditional use sites, provide for the continuance of potential traditional activities, and help develop culturally sensitive interpretive programs.

Stormwater Management

Stormwater would continue to be allowed to enter the monument provided that the Albuquerque Metropolitan Arroyo Flood Control Authority and the city's Hydrology Division use their authorities to regulate development and drainage improvements upstream of the monument that ensure stormwater coming into the monument does not derogate the values and purposes for which the monument was established.

Stormwater flows and effects on monument resources would be monitored, and control measures would be reviewed on a regular basis.

Interpretation and the Visitor Experience

Interpretation is an educational activity that is designed to stimulate curiosity, convey messages to the visiting public, and help the public understand, enjoy, appreciate, and protect the resources. Interpretation includes telling visitors what there is to see and how to get there as well as determining what visitors should learn about the monument and how they would best learn that information — through media such as an audio-visual program, a wayside exhibit (an outside interpretive panel), a self-guiding brochure, a guided tour, or some other means. Interpretation is also an important means of protecting resources. The more visitors know about how special the resources are, the more inclined they are to respect and take care of those resources.

Under all alternatives, monument visitors would be directed to the visitor center or visitor contact facility to get basic orientation, interpretation, safety, and resource protection information before seeing the petroglyphs. Under all alternatives, visitors would have diverse opportunities to see the petroglyphs and other monument resources.

Visitors could only see the petroglyphs by pedestrian trails, and not all petroglyphs would be accessible to the public. Horses, bicycles, and dogs would not be allowed near petroglyph viewing areas in the canyons below the escarpment.

A major component of the interpretive message would be to convey present-day American Indians' connection to the petroglyphs and the landscape to visitors. This message would include information that has been developed with the American Indian community about past and present cultures to give visitors enough information and experience to appreciate and

respect the monument resources. Various communication techniques would encourage maximum visitor cooperation in resource protection. Important messages, including primary interpretive themes (described below) and resource protection concerns, would be repeated/reinforced in several ways and at several points during a visit. Heritage education programs would be a top priority for the monument.

ALTERNATIVE 1

The overall approach of alternative 1, the proposed action and National Park Service's preferred alternative, would be to provide various ways for visitors of different ages and abilities to see and appreciate many of the monument's significant resources. Resource preservation would be accomplished by establishing a strong managing agency presence and public education programs.

Visitors would be directed to a visitor center/heritage education center at Boca Negra Canyon where they would have opportunities to learn about the significance of the monument resources and past cultures that have lived in the region and have easy access to many and varied petroglyph viewing areas and other portions of the monument. This alternative focuses visitors on seeing the petroglyphs within the context of the escarpment, mesa top, volcanoes, Rio Grande valley, and the Sandia Mountains. If use of the education center increases and conflicts with visitor center use, a new heritage education center would be built south of Rinconada Canyon near the water tank. The National Park Service and the city would work to develop partnerships with other public institutions, private industry, and non-profit organizations to assist in funding and operating the center.

Horseback and bicycle riding would only be permitted on designated mesa-top trails. No horseback or bicycle riding would be permitted in petroglyph viewing areas below the escarpment. There would be three escarpment crossings. Horse and bicycle use on the mesa top would require permits. Mesa-top resources and visitor experiences would be monitored to identify adverse impacts and to identify needs for management actions.

A new petroglyph research center would be built south of Boca Negra Canyon, along with a new administrative headquarters. There would be a city-owned and -managed visitor contact facility outside the monument south of the Piedras Marcadas Pueblo ruin.

A 10.5-acre boundary adjustment would be made to include lands south of Boca Negra Canyon and north of Mojave (five lots on Mojave east of Unser Boulevard) to protect views from the visitor center, provide additional lands for visitor service facilities, and prevent incompatible development that would adversely affect visitor use.

Most impacts on the cultural and natural resources and other impact topics would be minimal or, in some cases, beneficial. New structures would impact the cultural landscape. There could be adverse impacts on values held by culturally affiliated groups from the intrusion of bicycles and horses into lands that are important to those groups. Mitigating measures would be developed to avoid significant adverse impacts on the ferruginous hawk, which is being considered for listing by the U.S. Fish and Wildlife Service as a threatened species. Without these mitigating measures, the ferruginous hawk would be significantly adversely affected. The destruction of potential habitat of two rare cactus species could incrementally contribute to their overall decline.

ALTERNATIVE 2

The overall approach of alternative 2 would be that less development and therefore less use would provide greater protection for monument resources. This alternative would preserve the greatest portion of the monument and adjacent lands in as natural a condition as possible, with the fewest intrusions from development and fewer opportunities for public access and use. Visitors would be directed to a visitor center at Lava Shadows that would have the same programs as in the proposed action. Visitors would have access to selected petroglyphs in the Lava Shadows area and would walk about a mile or drive to other petroglyph concentrations.

A heritage education center would be built at Boca Negra Canyon. Because of the more difficult access to Rinconada Canyon, fewer visitors would go there and there would be more opportunities to see petroglyphs with a sense of solitude. The petroglyph research center would be offsite, and a city-owned and -managed visitor contact facility would be developed outside monument lands south of the Piedras Marcadas Pueblo ruin.

The volcanoes area, along with the geologic windows, would be reserved for research, American Indian traditional use, and occasional guided tours.

Horse and bicycle use would not be permitted in this alternative except at two escarpment crossings.

This alternative would include a 129-acre boundary addition of the mesa-top lands between 81st Street and the monument boundary to provide for the improvement of 81st Street and a new trailhead, parking, and viewing and picnic area at the south end of 81st Street. This land is part of the cultural landscape and a visual and

physical extension of monument and open space lands. This addition would provide substantial opportunities for visitors to enjoy the views relatively unimpaired by proposed development.

Also under this alternative it is recommended that a private/public partnership be established to protect about 475 acres west of the monument, east of the proposed Unser Boulevard, and north of Boca Negra Canyon. Portions of this area would be managed and protected by nonfederal methods for open space and recreational uses, and other portions of the area could take the form of a planned community.

Overall, impacts on cultural and natural resources and values held by culturally affiliated groups would be similar to and in some cases slightly more positive under this alternative than alternative 1 because there would be fewer facilities and these facilities would be in previously disturbed areas. The impacts on the ferruginous hawk and the potential habitat of two rare cactus species would be the same as in alternative 1 but less severe. As in alternative 1, mitigation measures would be required to avoid significant adverse impacts.

ALTERNATIVE 3

The overall approach of alternative 3 would be to provide the easiest and greatest amount of access to areas with many petroglyphs and to the scenic mesa-top vistas. Visitors would be directed to a visitor center/heritage education center in Rinconada Canyon where many petroglyphs could be seen without visual intrusions from adjacent residential development.

Interpretive programs would include similar information as in the other alternatives about the petroglyphs, their context, and

past cultures. There would be more emphasis on the mesa-top scenic views under this alternative. From the visitor center, many visitors would drive to a 10-mile, mesa-top loop road that would provide easy access to the mesa-top views and the volcanoes.

Parking and trails would be developed at the volcanoes and geologic windows areas. Horse and bicycle use would be provided at three escarpment crossings. A new petroglyph research center would be built just north of Piedras Marcadas Canyon, and there would be a city-owned and city-managed visitor contact facility outside monument lands south of the Piedras Marcadas Pueblo ruin.

Developing the mesa-top road and facilities in Rinconada Canyon would adversely impact the cultural landscape and its significance to the Pueblo community. This alternative would negatively impact more archeological sites, would result in more negative cumulative impacts on cultural resources and values held by culturally affiliated groups, and would require more costly programs to mitigate than the other alternatives. Visitor facilities would provide easy access to primary resources and allow all visitors to appreciate one of the monument's outstanding petroglyph concentrations in Rinconada Canyon. The facilities would also establish a greater management presence and protection for cultural resources; however, there could be negative impacts, including relic hunting and vandalism, because of the easier access.

The ferruginous hawk would be eliminated from the area as a breeding species, and this would be a significant adverse impact. The development on potential habitat for the two rare cactus would be a significant adverse effect. Other wildlife populations would also decrease.

With the construction of the mesa-top road, natural drainage patterns would be disturbed and noise levels would be greater than in the other alternatives. Monument biodiversity would also be more adversely impacted under this alternative because of species displacement from monument and adjacent development. Adverse impacts on the monument's scenic resources would also be greater under this alternative.

ALTERNATIVE 4

Alternative 4, a "no-action" alternative, describes the conditions that would exist at the monument without a change in current management direction or an approved management plan — providing a baseline for evaluating the changes and impacts that would occur under the three action alternatives. Under this alternative some provisions would be made for increases in visitor use — e.g., parking areas and trails. A separate heritage education center would not be constructed; monument staff would continue to give guided tours to school groups and bring interpretive programs to the classrooms. This alternative would have the fewest facilities. Horseback and bicycle riding would be permitted in the monument only where currently allowed.

The existing interim visitor center at Lava Shadows would become the primary visitor center. Some modifications would be made by the city at Boca Negra Canyon, such as improved parking area and restrooms, trails, and shade structure. There would be two new small parking areas, one each near Rinconada and Piedras Marcadas Canyons, and some improvements to existing trails in these canyons. Mesa Prieta would be accessible only by pedestrian trails. The research center functions would be carried out by existing staff in existing facilities within the

existing budget. The Piedras Marcadas Pueblo ruin would be closed except for specially arranged tours.

There would be adverse impacts on archaeological sites, petroglyphs, and the cultural landscape because of the resource deterioration and vandalism that could occur due to lack of adequate funding, opportunities to educate the public, and programs to protect these resources. The meaning and viability of the Pueblo peoples' religion and culture could diminish.

There would not be significant adverse impacts on the ferruginous hawk or the potential rare cactus species habitat. Without permits to regulate visitor use, there could be negative impacts on other wildlife species. Biodiversity might decrease because of species displacement on lands adjacent to the monument. Most of the monument's natural scenic qualities would not be disturbed by the development of new facilities. There would be less economic benefits to the local and regional economy. Visitors would have fewer opportunities to appreciate monument resources than in the other alternatives.

THE NEXT STEP

The public review and comment period for this draft document will be 90 days. Public

meetings will be held during the public comment period. Comments on the draft plan will be summarized, and appropriate changes will be made to the document to respond to public comments. Various elements of the preferred alternative and other alternatives might be modified to address comments. A *Final General Management Plan / Development Concept Plan / Environmental Impact Statement* will then be issued, which will become an approved plan 30 days after a record of decision is issued. The *Final General Management Plan / Development Concept Plan / Environmental Impact Statement* will include agency and organization letters and responses to all substantive comments.

Comments on or questions about the *Draft General Management Plan / Development Concept Plan / Environmental Impact Statement*, which must be received by November 6, 1995, should be addressed to

Superintendent, Petroglyph National Monument
4735 Unser Boulevard NW
Albuquerque, NM 87120
(505) 839-4429

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PURPOSE AND NEED FOR THE PLAN



Mesa Prieta from Rinconada peninsula looking southwest



Petroglyphs, Piedras Marcadas Canyon



Interpretive ranger with school group

INTRODUCTION

PURPOSE OF AND NEED FOR THE PLAN

The purpose of this *Draft General Management Plan / Development Concept Plan / Environmental Impact Statement* for Petroglyph National Monument is to set forth the basic management philosophy of the monument and the overall approaches to resource management, visitor use, and facility development that would be implemented over the next 10–15 years. This combined plan and environmental impact statement have been prepared to meet the requirements of Public Law 101-313 (the legislation that established the monument; see appendix A) and the National Environmental Policy Act and its regulations. In addition, according to NPS management policies, all other plans for the monument would be consistent with the direction established in this lead planning document.

The principal lands in the monument that are developed and managed for visitor use are within the Indian Petroglyph State Park, now known as the Boca Negra Canyon unit. Other existing facilities include a small interim visitor center at Lava Shadows and a parking area near the volcanoes. The public lands within the monument have many abandoned dirt roads and trails that are used by walkers, joggers, bicycle and horseback riders, and people walking their dogs. The existing facilities do not adequately serve current or projected visitor and resource management needs and legislative mandates.

This *General Management Plan* identifies, within the legislative parameters, reasonable use and development alternatives to ensure protection of the resources that prompted inclusion of Petroglyph National Monument into the

national park system and to provide for compatible public use and enjoyment of those resources. As directed by the monument legislation, the National Park Service has taken the lead in preparing the *General Management Plan / Development Concept Plan / Environmental Impact Statement* for the secretary of the interior in cooperation with the city of Albuquerque (hereafter referred to as the city) and the state of New Mexico (hereafter referred to as the state).

The plan identifies management goals, research needs and opportunities, resource and visitor use actions and programs, the functions and general locations of needed facilities, and the roles and responsibilities that will be assumed by federal, state, and city agencies; the plan also proposes boundary adjustments.

Specifically, as stated in the law establishing the monument, PL 101-313, this plan will address the following:

- the number of visitors and the types of public use that can be accommodated while protecting the monument resources
- a resource protection program
- a general interpretive program
- a plan to implement the American Indian Religious Freedom Act
- a general development plan, including proposals for a visitor center and the estimated cost thereof
- a plan for a petroglyph research center

This plan and environmental impact statement identifies significant issues and concerns facing monument managers, presents a reasonable range of management, resource protection, and development alternatives, and analyzes the effects of implementing each alternative. The plan

and environmental analysis reflect information received to date during consultation with the Indian community. The environmental analysis in this document does not address the impacts of designation (passage of law by Congress) in June 1990. Congressional acts are exempt from compliance with the National Environmental Policy Act.

Because monument managers are told that the petroglyphs and their context are sacred to the Pueblo and the Atrisco land grant peoples, the petroglyphs must be seen as much more than visual art. Common use of the term "rock art" for petroglyphs and pictographs might minimize or trivialize this significance. Thus, other than in references to legislative mandates the term rock art will not be used in this document or in any interpretive materials developed by the monument. Pictographs are included when the term petroglyph(s) is used in this document.

BRIEF DESCRIPTION OF THE MONUMENT

Petroglyph National Monument, encompassing 7,244 acres, was established in June 1990 as a new unit of the national park system to preserve the more than 15,000 prehistoric and historic petroglyphs and other significant natural and cultural resources that are on the west side of Albuquerque, New Mexico (see Region, Vicinity, and Existing Conditions maps).

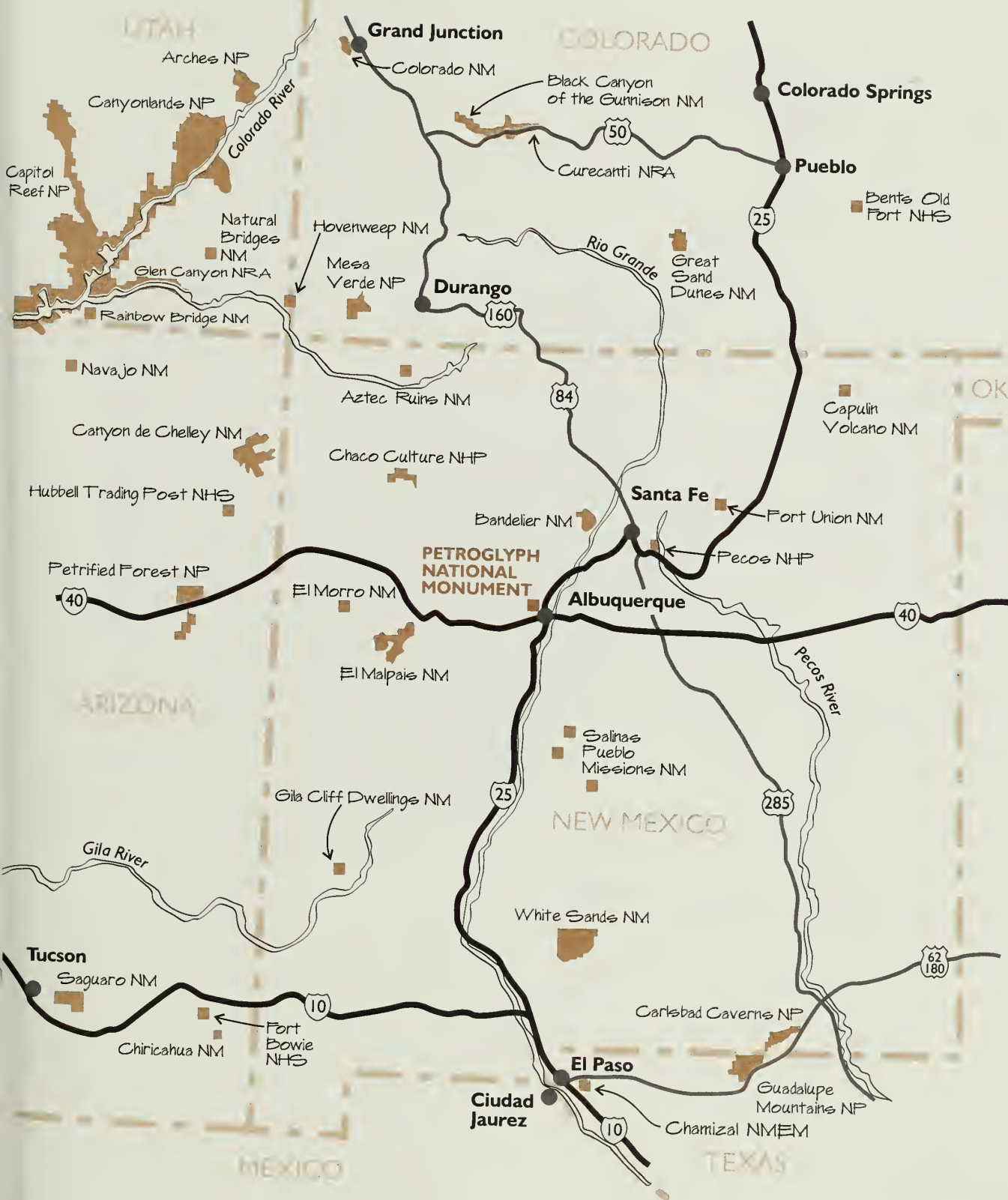
The major landscape feature of Albuquerque's western horizon is the west mesa, which was created by a series of volcanic eruptions and lava flows about 190,000 years ago. What remains of those eruptions are the mesa, with its five volcanic "cones," and the dark, winding, 17-mile-long escarpment. The petroglyphs are symbols or figures that have been

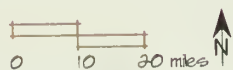
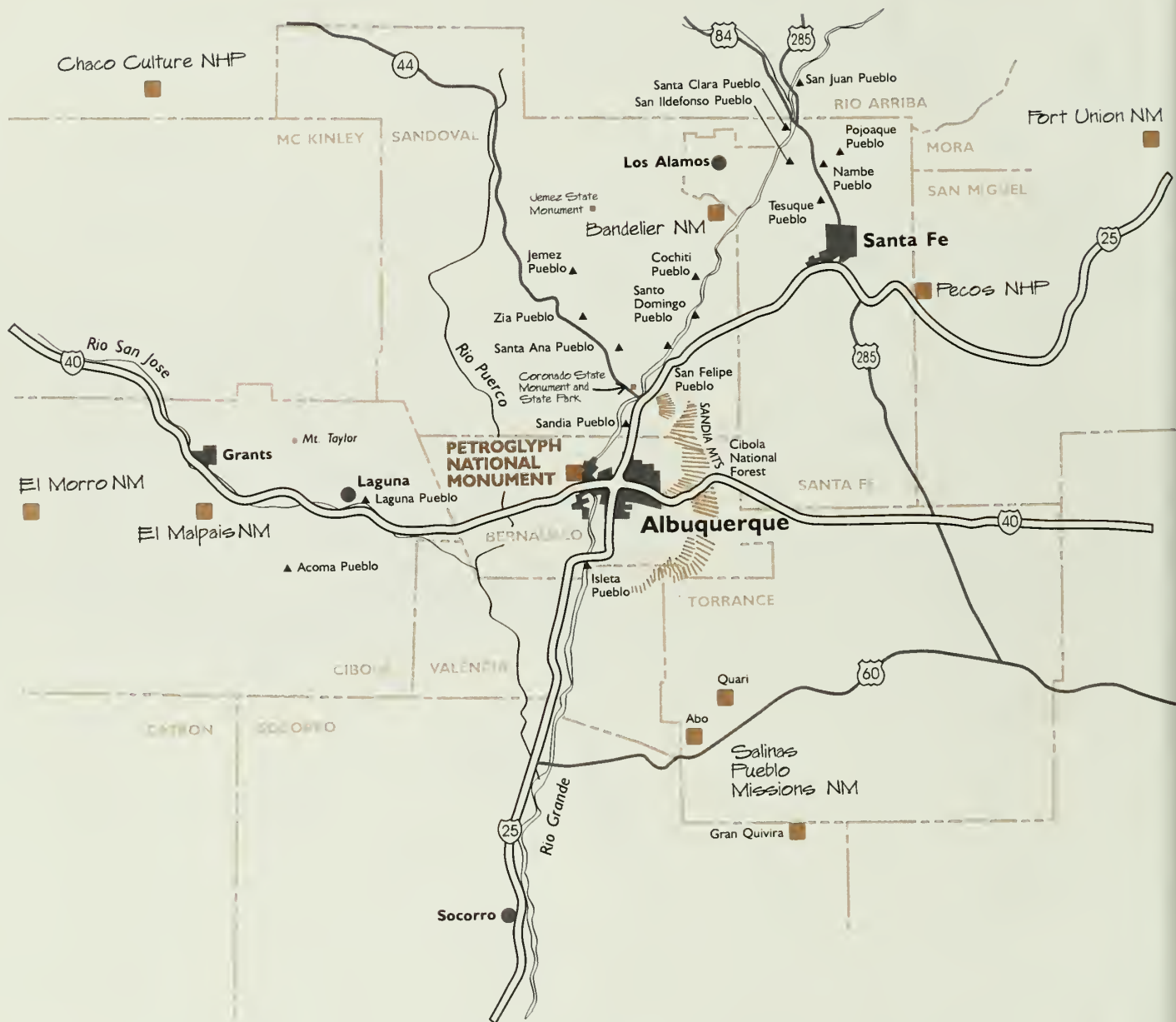
scratched, pecked, or abraded on the dark patina of the basaltic rocks of this escarpment.

It is estimated that most of the petroglyphs were created between A.D. 1300 and A.D. 1600; others are estimated to be 2,000 to 3,000 years old, and some date from the early Spanish use of the area from the 1650s to the 20th century. Although the petroglyphs occur along the entire escarpment and along the mesa-top arroyos, four areas along the mesa escarpment have concentrations of many petroglyphs within relatively small areas — Piedras Marcadas Canyon, Boca Negra Canyon, Rinconada Canyon, and Mesa Prieta.

The petroglyph images include abstract and geometric designs and figures of reptiles, birds, large mammals, masked and horned serpents, as well as four-pointed stars, flute players, and other anthropomorphic figures. This collection of "piedras marcadas" ("marked rocks") illustrates the rich complexity of Puebloan cultural expression. Although the images may be appreciated by non-Indians as a rich visual gallery of prehistoric artistry, they have a much deeper religious and cultural meaning to present-day Pueblo peoples. The Indian community has said that the placement of the petroglyph images was purposeful and that their meaning and significance are inseparable from the landscape, nearby landforms, and other petroglyphs. The petroglyphs are part of the natural setting and the cultural landscape (defined below). Researchers also consider the petroglyphs significant for the insight into past cultural history and for their potential to contribute to understanding the ideological diversity among Pueblo groups of the Southwest.

Equally important as the petroglyphs and their context, however, is the landscape of the monument. The entire west mesa landscape, including views from the mesa



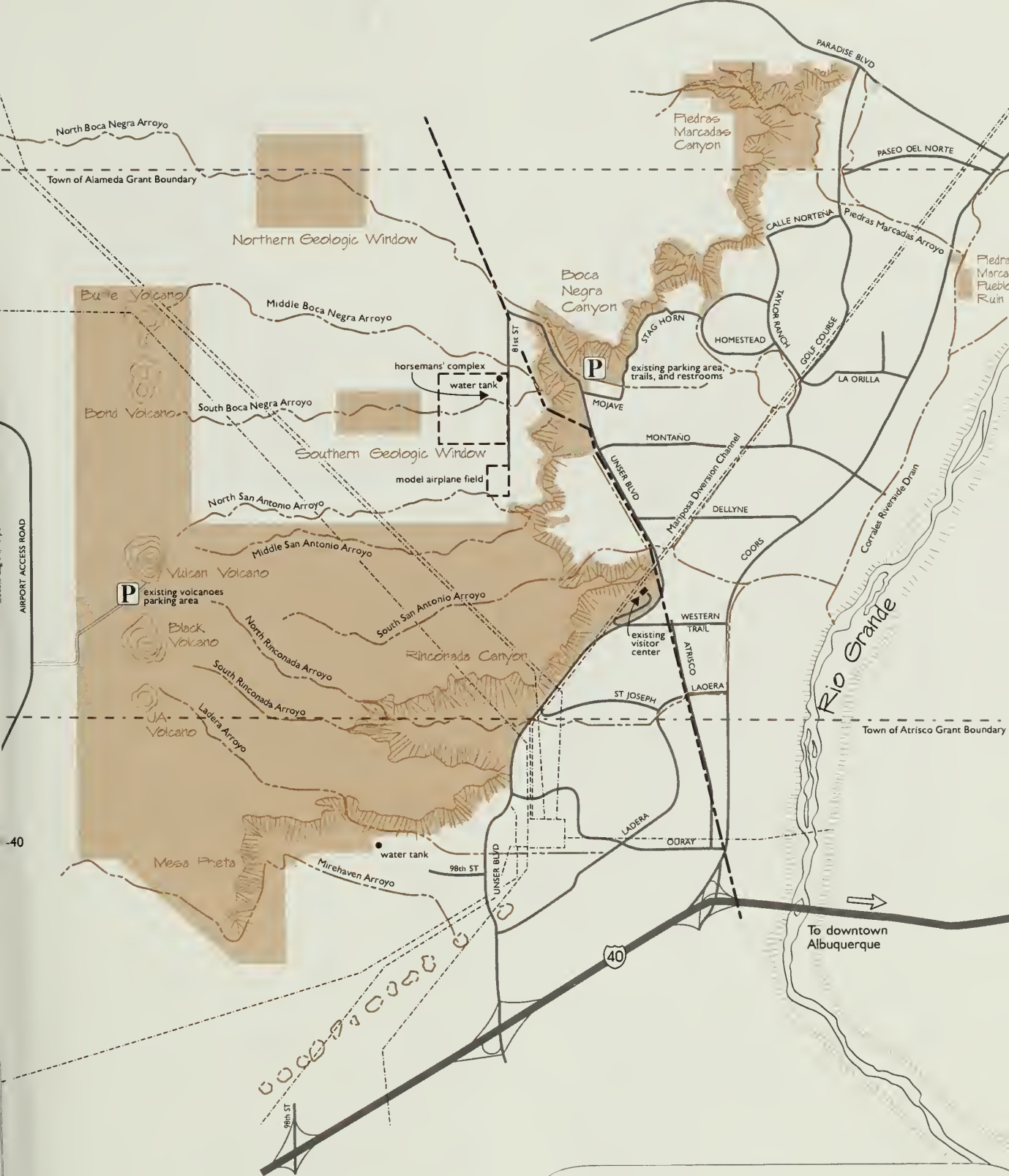


Vicinity

Petroglyph National Monument

United States Department of the Interior
National Park Service

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- arroyo
- utility lines
- gas line
- Petroglyph National Monument
- escarpment

Existing Conditions **Petroglyph National Monument**

United States Department of the Interior
National Park Service

to the Sandia and Manzano Mountains, the volcanoes, and the other natural resources and features are also considered sacred and significant to the Pueblo people. Special knowledge of monument features, shrines, and petroglyphs have been passed from generation to generation for centuries. This landscape has continued as a part of the cultural identity of these peoples — a place of spiritual meaning where Indian people have come for worship and renewal. It is also a place whose timeless and natural beauty and sense of spirituality can be appreciated and respected by others.

Existing development within the monument includes a residence that has been converted to an interim visitor center at Lava Shadows. It has a small book sales area, information desk, one public restroom, and office space for five interpretive rangers. The visitor center can accommodate up to 20 visitors at one time. Another building in the vicinity (formerly used as three small apartments) was converted to office space for the chief ranger and two law enforcement rangers. Two abandoned residences near the visitor center are scheduled to be removed. Also adjacent to the interim visitor center is an occupied residential property that has been recommended for acquisition. The current NPS staff includes 13 full-time employees and five seasonal employees.

The primary visitor use area to see petroglyphs and to walk from the base to the top of the escarpment is at Boca Negra Canyon. This area was acquired by the city in 1973 and developed as Indian Petroglyph State Park with state funds. Since establishment of the monument, the city Open Space Division and the National Park Service have jointly conducted educational programs and law enforcement at Boca Negra Canyon.

An entrance station at Boca Negra Canyon is used by the city's Open Space Division for visitor contact and fee collection. There are three paved trails that provide easy access to several petroglyph concentrations and the mesa top.

There are two other structures on land that was recently acquired south of Boca Negra Canyon. These buildings will be used for interim NPS offices.

The monument is adjacent to and partially within the city of Albuquerque. Existing and proposed residential areas, such as Las Marcadas, Shenandoah, Taylor Ranch, Santa Fe Village, and Park West, abut the eastern monument boundary and the escarpment. Vacant lands south of the monument are being planned for residential and resort development. The Double Eagle II Airport, a general aviation airport, is west of the monument. Lands north of the monument are owned partially by the city Open Space Division and partially by the Paradise Hills residential community (see Existing Land Use map).

The monument appears to be eligible for listing on the National Register of Historic Places as a cultural landscape. A cultural landscape is defined as a geographic area, including both cultural and natural resources, associated with an event, activity, or person or exhibiting other cultural or aesthetic values. Further documentation will be prepared to re-nominate the monument to the National Register of Historic Places as resource inventories and analyses are completed.

The monument also includes more than 300 other archeological sites (the petroglyphs are archeological sites with the same significance and values as the other more common surface and subsurface sites). Among these sites is the largest unexcavated pueblo in the middle Rio Grande valley, known as the Piedras



Existing Land Use

Petroglyph National Monument

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Marcadas Pueblo ruin. The ruins are what remains of a two- to three-story pueblo that is thought to have contained 1,000 rooms. The earthen walls of the pueblo have eroded, and the site is buried and covered with vegetation. From a distance the site appears the same as the surrounding landscape. This pueblo complex appears to have been inhabited for about 300 years (ca. A.D. 1300 to A.D. 1600). The occupants of this pueblo may have been responsible for many of the petroglyphs in the Piedras Marcadas Canyon and other areas along the escarpment.

The five volcanoes (JA, Black, Vulcan, Bond, and Butte) line the western edge of the monument and frame Albuquerque's western skyline. Pueblo groups feel that the volcanoes are connected spiritually and visually to both the escarpment petroglyphs and the Sandia Mountains. They recognize a sacred relationship among the volcanoes, the rocks, the mountains, and the medicinal plants.

There are also two geologic "windows" on the mesa top; these noncontiguous portions of the monument are depressions or windows into the mesa's geologic strata along the arroyos. There are many petroglyphs in these depressions, and these areas also offer opportunities for visitors to be isolated from the Albuquerque urban environment. The Pueblo community has stated that these features also have religious and cultural significance.

The vegetation and wildlife in the monument are typical of central New Mexico. However, there are microhabitats along the escarpment that retain warmth and moisture and provide shelter for a greater variety of species than the surrounding terrain. These microclimates support some plant species that are typically found farther south. Their presence in the monument represents the northernmost extreme for these species.

The mesa provides panoramic views of Albuquerque, the Rio Grande Bosque (Spanish for forest and referring to the forested Rio Grande floodplain), and the Sandia and Manzano Mountains east of Albuquerque. West of the monument are the Rio Puerco valley and Mt. Taylor.

About 1,475 acres of lands in the monument are owned by the federal government, about 3,811 acres are owned by the city, and about 642 acres are owned by the state (see Landownership map). The remaining private lands (approximately 1,315 acres) will be acquired as funds are appropriated by Congress and the city and the state for land acquisition. City open space and existing and proposed city trails provide opportunities to connect with the monument and former mesa-top roads and trails (see Existing and Proposed City Trails and Monument Roads and Trails maps).

BACKGROUND AND LEGISLATIVE DIRECTION

A 1986 survey of the west mesa petroglyphs, done by Matthew Schmader and John Hays, led to the national register nomination of the Las Imagines Archeological District in 1986. During the late 1980s, citizen groups approached Congress and requested federal assistance in protecting the area's values. The National Park Service completed a *New Area Report, Study of Alternatives, Albuquerque West Mesa Petroglyph Study* in 1988 that identified three alternative management approaches and boundary configurations for the west mesa. Congress responded by passing Public Law 101-313 on June 27, 1990, creating Petroglyph National Monument — the first national park system area specifically established to protect and interpret rock carvings and their setting and to





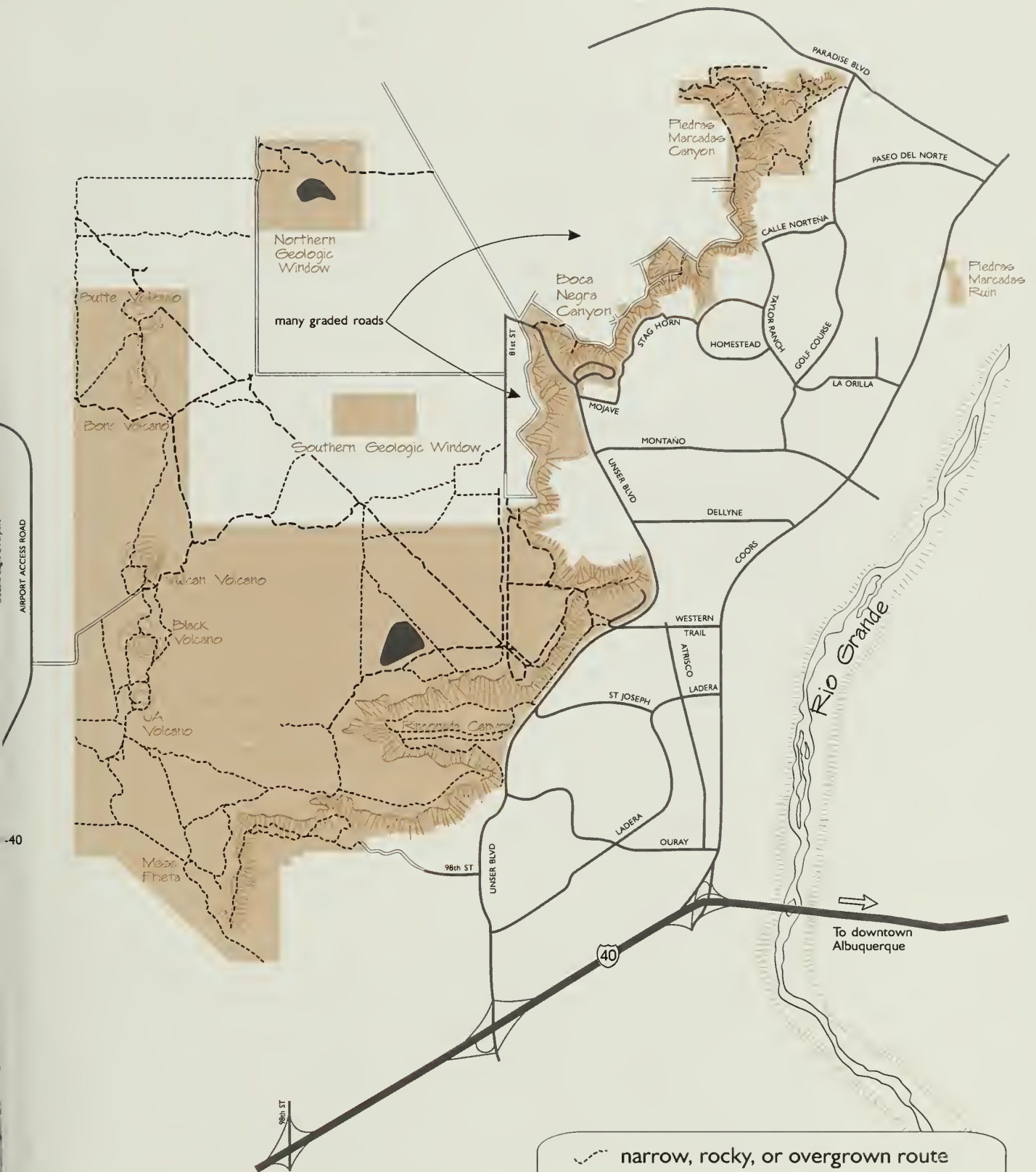
Existing and Proposed City Trails

Petroglyph National Monument

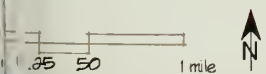
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-  existing city trail
-  proposed city trail
-  Petroglyph National Monument
-  escarpment



- narrow, rocky, or overgrown route
- unmaintained dirt road
- graded road
- abandoned motocross area
- Petroglyph National Monument
- escarpment



Monument Roads and Trails

Petroglyph National Monument
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preserve, for the benefit and enjoyment of present and future generations . . . the nationally significant West Mesa Escarpment, the Las Imagines National Archeological District, a portion of the Atrisco Land Grant, and other significant natural and cultural resources, and to facilitate research activities associated with the resources.

The monument established by Congress consisted of approximately 5,280 acres and is generally known as the Atrisco unit. With the signing of a binding agreement in March 1992 by the city, the state, and the National Park Service, the monument was expanded to 7,160 acres — to include the 215-acre Boca Negra unit and the 1,179-acre Piedras Marcadas unit.

Pursuant to Public Law 101-313 and after consultation with the Petroglyph National Monument Advisory Commission (see below), 95 acres of land in two other boundary addition areas — commonly known as the northern addition and the Lava Shadows addition — were authorized for acquisition and incorporation into the national monument. These additions, a total of 84 acres, were made in June 1994.

As are many recent additions to the national park system, Petroglyph National Monument was envisioned by Congress to be a partnership where lands would continue to be owned not only by the federal government but also by the city and the state. The partners are working together to develop plans, collect data, maintain existing facilities, determine the roles and responsibilities of each partner, and manage natural and cultural resources.

Public Law 101-313 states that

- federal laws that are generally applicable to units of the national park system shall apply to the monument
- the National Park Service may participate in land use and transportation planning for lands adjacent to the monument
- the secretary of the interior shall prepare a general management plan in cooperation with the city and the state

This legislation also authorizes the establishment of the Petroglyph National Monument Advisory Commission to advise the secretary of the interior on the management and development of the monument and on the preparation of the general management plan. The 11-member commission is made up of nominees who are appointed by the secretary for five-year terms. The commission has met on several occasions over the past two years.

In addition, the legislation directs the National Park Service to conduct research on other Rio Grande style petroglyphs on federal lands in New Mexico and, through cooperative agreements with state and private landowners, on nonfederal lands.

GENERAL MANAGEMENT PLANNING — THE PROCESS

The general management process consists of the following steps: establishing a planning team, involving and consulting with American Indian groups and Atrisco heirs, developing purpose and significance statements, identifying the issues and collecting data, developing management objectives and interpretive themes, and generating and evaluating the alternatives.

Establishing a Planning Team

The first step in the planning process was establishing an intergovernmental core

planning team to coordinate and prepare the *General Management Plan / Development Concept Plan / Environmental Impact Statement*. Because of the partnership nature of Petroglyph National Monument, the general management plan is being prepared by a core team that includes representatives from four city agencies, two state agencies, the American Indian Pueblo community, the Federal Aviation Administration, and the National Park Service. The core team has met throughout the planning process to develop and refine statements of purpose, to identify the significant resources of and the objectives for the monument, to develop alternatives for visitor use and management, and to assess the impacts of implementing each of the alternatives.

To ensure participation from the many governmental agencies that are concerned with the monument, an agency coordinating team was established. The coordinating team includes representatives with expertise in various disciplines from city, county, state, and federal agencies as well as American Indian governments. The coordinating team advises the core team regarding past, ongoing, and proposed projects and programs that have an effect on the monument as well as providing input on various aspects of the plan preparation.

Public Involvement and Consultation

Throughout the planning process the team has met with governmental organizations, American Indian groups, Atrisco heirs, neighborhood groups, and other interested people to identify issues and exchange information. Another participant in preparing the *General Management Plan* is

the Petroglyph National Monument Advisory Commission. As directed by monument legislation, the commission is composed of representatives from various interested entities throughout the region. The National Park Service keeps the advisory commission informed of their planning activities and regularly consults with the advisory commission. The advisory commission has taken a very active interest in planning for the monument and met regularly with the Park Service to review alternatives and make recommendations regarding other alternatives.

The planning team has also involved, consulted, and informed the Pueblo Indian communities of the planning process and issues that could affect lands that are significant to them. The initial step was to conduct a rapid ethnographic assessment (Evans et al. 1993) to initiate contacts with American Indian groups to determine which groups wanted to be involved with the monument planning process, what their concerns were about monument planning, and what would be the best way for them to participate in the planning process.

Based on the results of the ethnographic assessment, American Indian representatives were invited to participate in core team meetings. Monument staff and planning team members have both short- and long-term interests in meeting with American Indian representatives and in understanding their interests. The short-term interests are addressed in this plan; the long-term interests include continuing involvement in the management of cultural resources, the interpretive program, and research.

**Purpose and Significance
of the Monument**

The monument's purposes and significance were developed based on the legislation that established the monument. The monument's purposes identify why the area was designated to be part of the national park system and the significance statements identify the national importance of the monument's cultural and natural resources. Purpose and significance statements, which are basic to all assumptions about the monument and the ways it should be managed and developed, are important to planning and management because they help define the management priorities for the monument.

Based on public comments and a close look at the legislation and the legislative history, the core team identified the following purpose and significance statements below.

**Identifying the Issues
and Collecting Data**

The issues are presented in later "Planning Issues and Concerns" section, and the data that has been collected, or that is still needed, is presented throughout the entire document and in the appendixes.

**Developing Management Objectives
and Interpretive Themes**

Management objectives were developed and are included in appendix B. The interpretive themes are presented under "Interpretation and the Visitor Experience" in the "Actions Common to All Alternatives" section.

PURPOSES OF THE MONUMENT	SIGNIFICANCE OF THE MONUMENT
• Preserve the integrity of the cultural and natural resources in the context that gives them meaning. • Provide opportunities for diverse groups to understand, appreciate, and experience the monument in ways that are compatible with the monument's significance. • Cooperate with affected American Indians and Atrisco land grant heirs in perpetuating their heritage. • Function as a focal point for the collection, analysis, and dissemination of information relating to Rio Grande style and other forms of petroglyphs and pictographs.	• The monument contains one of the largest concentrations of petroglyphs in North America and represents an extensive record of peoples for whom we have few written records. • The monument has outstanding research potential because the petroglyphs are numerous, have retained their integrity, are an outstanding example of Rio Grande style, and are close to other associated archeological resources. • Places in the monument have traditional, cultural, and spiritual importance to American Indians and Atrisco land grant heirs. • The Piedras Marcadas Pueblo ruin is one of the largest pueblos of its time period in the Rio Grande valley. • The monument's natural and cultural landscape (escarpment, volcanic cones, and surrounding open space) and long vistas are major elements that define Albuquerque's western horizon and provide opportunities to experience contrasts with a growing urban environment.

Generating and Evaluating Alternatives

The alternative development process is the combination of the above factors and the direction provided by legislation, the issues and opportunities identified through scoping, the overall concepts for visitor use and resource management, and the continuing refinement through consultation with various interest groups and agency staff. This process is described in greater detail in the "Introduction" to the alternatives, the "Environmental Consequences," the "Consultation and Coordination" sections of this document as well as in appendix C.

Draft Review and Final Document Preparation

The *Draft Management Plan / Environmental Impact Statement* will be reviewed by the public during a 90-day public comment period that will include public meetings. Comments on the *Draft General Management Plan / Environmental Impact Statement* will be analyzed, and appropriate revisions will be made in the *Final General Management Plan / Environmental Impact Statement*. Various elements of the preferred alternative and other alternatives might be modified or interchanged in the final plan. The final document will include responses to substantive comments.

PLANNING ISSUES AND CONCERNS

Several planning issues and concerns, which are addressed in this document, were identified in meetings with concerned agencies, organizations, and individuals (for additional information, see the "Consultation and Coordination" section). These issues and concerns are summarized below.

PARTNERSHIP JURISDICTION, ROLES, AND RESPONSIBILITIES

Petroglyph National Monument was legislated in June 1990 by Congress as a monument that would function as a partnership between the National Park Service, the city of Albuquerque, and the state of New Mexico. Three units were identified — the Atrisco unit in which the lands are owned by the federal government, the Boca Negra unit in which lands are owned by the state and city, and the Piedras Marcadas unit in which lands are owned by the city. However, the legislation was also clear in stating that all lands within the monument boundary, regardless of ownership, are to be managed according to federal laws that apply to all units of the national park system. Lands within the monument will continue to be owned by the city, state, and the federal government and managed by the National Park Service and the city Open Space Division. The issue is how to best define the roles and responsibilities of the agencies.

PETROGLYPH PROTECTION AND MANAGEMENT

Petroglyphs are vulnerable to intentional and unintentional destruction. Unintentional vandalism may be caused by touching, rubbing, or highlighting the petroglyphs with chalk or other materials.

Petroglyphs are vulnerable to oils from human hands and people climbing on them (which erodes the patina). Intentional vandalism on monument lands includes removing the rocks and/or chiseling, spray painting, scratching, and shooting guns, which deface the rocks and/or the patina of the rocks along the escarpment, including the rocks without petroglyphs. Removing significant associated features, such as nearby plants and other rocks or boulders, may adversely affect the qualities that give the petroglyphs spiritual meaning for the Pueblo people. One issue for monument managers is how to prevent resource damage and still allow people to enjoy the monument. Another issue is how to restore areas that have already been vandalized.

The legislation establishing the monument directs that a plan be prepared for a petroglyph research center. The issue is determining the purpose, size of development, management, and location for this center and how to conduct the research without adversely affecting Pueblo and indigenous communities.

ARCHEOLOGY

Another issue for monument managers is how to protect the monument's 300+ archeological sites from intentional and inadvertent destruction by monument visitors. The risk of destroying archeological sites increases as visitor use increases and as adjacent development continues near the monument boundary. Another concern is archeological sites that are threatened by erosion.

CULTURAL LANDSCAPE

A cultural landscape overview was conducted by the National Park Service to gather information about past use of the monument lands and to identify features that define the cultural landscape. Actions proposed in this plan and the alternatives would have different impacts on the cultural landscape. The issue is how best to preserve significant cultural landscape features while also providing for visitor use.

THE AMERICAN INDIAN COMMUNITY AND ETHNOGRAPHIC RESOURCES

The American Indian Pueblo community has ancestral ties to lands that include the monument, and the monument holds spiritual meaning and is still a place of worship for the Pueblo people. The issue is how to comply with the American Indian Religious Freedom Act — to protect the resources and provide reasonable access for these people to use sacred sites in the monument for worship and traditional rites and keep visitors from adversely affecting religious activities — while minimizing conflicts with monument visitors and without adversely affecting monument resources or visitors' experiences.

The National Environmental Policy Act, *NPS Management Policies*, and *NPS Cultural Resources Management Guidelines* (NPS-28) also require consultation with Indian groups in planning and management activities that affect them. A related issue is how to ensure such consultation.

An equally important issue is how to learn more about the past use of monument lands while respecting the wishes of the American Indian Pueblo community. The Pueblo community may view any archeological investigation as desecration rather

than scientific inquiry, and some artifacts may have special religious significance.

HEIRS OF THE ATRISCO LAND GRANT

The heirs of the Atrisco land grant also claim ancestral ties to lands that include the monument. The management concern is how to document traditional use and where to provide for use by the heirs of portions of the monument without adversely affecting monument resources or visitors' experiences.

NATURAL RESOURCES

The canyons, exposed basalt, wildlife, vegetation, mesa top, arroyos, and other natural features in the monument are all part of the natural environment in which the petroglyphs were carved. In addition, habitat has been identified that may support a federal proposed and a state-listed rare plant species. The monument also provides habitat for many bird species, two of which are proposed for federal listing. Portions of the monument have been disturbed by illegal dumping, offroad vehicle use, and cinder mining. Proposed development and visitor activity could affect soils, air quality, biological diversity, and threatened and endangered species habitat. The issues are how to protect and restore these resources.

SCENIC RESOURCES

Views throughout the monument of nearby and distant landforms as well as views of the monument from many locations in the Albuquerque area are important monument and area resources. The protection of these views and vistas to and from the distinctive landforms of the monument, including the volcanoes, mesa, escarpment,

and the various canyon features, is critical to interpreting the significance of the monument. Views are being affected by adjacent development and could be adversely affected by monument facilities. The concern is how to protect the integrity of these views as much as possible while providing access to appreciate them.

INTERPRETATION

One question most visitors ask is what the petroglyphs literally mean. The challenge for the monument staff is to convey the significance and importance of the petroglyphs even though we do not know their literal meaning. They are associated with cultural/religious practices within the Pueblo community, practices that are private and have been kept that way for centuries. As special and sacred to the Pueblo community, these resources are worthy of being protected and treated with respect, just as most people respect churches, synagogues, cemeteries, battlefields, etc. The issue is how to convey this to monument visitors.

Interpreting the monument story requires sensitivity to contemporary Pueblo cultures and the Atrisco land grant heirs. Reproducing images of petroglyphs for interpretive media must be done carefully and only with prior consultation to avoid inappropriate use of sacred symbols. One of the primary challenges faced by monument managers is how to convey an appreciation, understanding, and sense of respect for the petroglyphs and their context.

At the same time, being a part of the growing Albuquerque metropolitan area provides many opportunities for heritage education. The issue is how best to take advantage of these opportunities and develop programs that reach out to the community.

HERITAGE EDUCATION

There are extensive heritage education program opportunities at the monument because of its location within the Albuquerque metropolitan area. Educational programs can play an integral role in protecting monument resources as well as expanding the understanding of past and present cultures. The issue is how to design and integrate education programs with monument and community resources.

VISITOR CIRCULATION AND ACCESS

Another concern is how to provide visitor access to the petroglyphs and other areas of interest without having adverse effects on sensitive archeological and ethnographic resources. Access, including access for visitors with disabilities, should avoid sensitive resources and intrusion on other visitors' experiences. Circulation issues include how to get visitors to the monument efficiently.

Some people want to have vehicle access to the mesa top for the experience and views. The issues are should this access be provided, and if so, what is the best way to do that without adverse affects on the monument resources.

PUBLIC USES

In the past, the monument has been used for shooting, bicycling, hiking, horseback riding, walking dogs, rock-climbing, offroad vehicle use, picnicking, grazing cattle, and hiking. Local visitors have been able to visit and enjoy the monument in relative solitude and without restrictions on these activities. With the creation of the monument and the acquisition of private lands, increasing visitation necessitates facilities, parking areas, established trails, and less solitude. A few of these past

activities were restricted or prohibited upon the creation of the monument. Other uses have not been addressed until this planning process began. As lands around the monument become increasingly developed, the monument is becoming more attractive for various public uses; many people, including adjacent residents, have expressed strong desires for these uses to continue. Some of these past uses may conflict with the needs for resource preservation and providing experiences for monument visitors. The issue is how to provide for use without adversely affecting resources and visitor experiences.

NEIGHBORHOOD INTERESTS

Residents from adjacent neighborhoods have concerns about monument visitors creating traffic congestion and parking problems in their neighborhoods. They do not want visitors directed into their neighborhoods to gain access to the monument. Residents along the boundary want trail access into the monument and have created informal social trails to the top of and along the escarpment. Creating these trails increases the risk of damage to archeological sites and natural resources. The issue is how to direct visitors to the monument without creating such problems and, if neighborhood trail access is appropriate, how best to provide that access while protecting monument resources.

STORMWATER DRAINAGE AND EROSION AND UTILITY RIGHTS-OF-WAY

Monument managers are concerned about preventing adverse effects of stormwater drainage and erosion on monument resources and on nearby residents who have homes below the escarpment. During rainstorms, water tends to pour off the escarpment edge, causing erosion and

sedimentation downstream. The Albuquerque Public Works Department, the Albuquerque Metropolitan Arroyo Flood Control Authority, and the development community have also expressed concern about how to carry stormwater from proposed development on the mesa top to existing drainage structures that carry stormwater to the Rio Grande.

The development community has stated that they did not intend for the monument to adversely impact further western development, which could include requests for utility rights-of-way across monument lands. Specific locations of utility crossings have not yet been identified by the city or other interested parties.

The issue is how and where to locate facilities on the west mesa, including structures for drainage and methods for preventing stormwater erosion, without adversely affecting monument resources — even if additional costs are involved.

BOUNDARY ADJUSTMENTS

Several areas have been considered as adjustments to the existing monument boundary. The issue is evaluating these areas, in accord with NPS policies and law, to determine the suitability and feasibility of these boundary adjustments.

ISSUES BEYOND THE SCOPE OF THIS GENERAL MANAGEMENT PLAN

Unser Middle Project — Unser Boulevard Continuation and Paseo del Norte

The city has proposed the development of the Unser Boulevard middle project, which includes Unser Boulevard (a four-lane major arterial parkway) and Paseo Del Norte (a four- to six-lane major arterial) — both of which would go through the

monument. The project includes (1) continuing Unser from Dellyne north to Paradise Boulevard (with an escarpment crossing south of Boca Negra Canyon in an existing disturbed area), (2) constructing Paseo del Norte from Unser east to Golf Course Road, and (3) developing a recreational trail and utility corridor in Boca Negra Canyon (the former Unser right-of-way), including the removal of the existing paved road in Boca Negra Canyon. This project is the subject of the 1992 *Final Environmental Impact Statement* (Leedshill-Herkenhoff 1992), which created considerable controversy. As of this writing, construction has not yet begun.

The purpose of new roadway construction for the Unser Boulevard and Paseo del Norte corridors is to provide improved transportation service on the west side of Albuquerque, to relieve existing and future traffic congestion on Coors Boulevard and other area arterials, and to distribute traffic in the most efficient manner to adequately serve east-west travel across the Rio Grande. Paseo del Norte is intended to be a freeway-type road that would serve the Double Eagle II Airport and complement the city road network. Paseo del Norte is initially planned to be four lanes, with the potential for future widening to six lanes.

The monument's establishing legislation states that federal laws generally applicable to units of the national park system shall apply to the monument. The continuation of Unser Boulevard would be consistent with protecting monument resources and purpose. The National Park Service has the authority to permit the construction of roads in national monuments when they serve a park purpose. The city's construction of the Unser extension, which goes around Boca Negra Canyon, would serve a monument purpose by reducing the noise and visual impacts that the current two-lane road now causes at Boca Negra Canyon. The

cumulative impacts of this proposed road corridor has been considered in this document.

The existing Unser alignment through Boca Negra Canyon would be replaced, by the city, with a multiuse trail that does not allow motorized vehicles and connects with proposed city trails and the relocated gas lines and a utility corridor (including a stormwater conduit). The recreational trail and utility corridor in Boca Negra Canyon would be confined to the area disturbed by the existing roadway. The Unser alignment through the monument would also be through an existing disturbed area that does not have any archeological sites. Both Unser Boulevard and the Boca Negra Canyon facilities must be designed to minimize impacts on monument resources. Further environmental and cultural resource compliance would be required.

However, under the federal laws that apply to the monument, there is no legal authority to allow Paseo Del Norte to cross the monument. The National Park Service, the state historic preservation officer, the state attorney general, and numerous other national and local groups have stated that (1) monument resources would be significantly impacted, (2) there is not a monument or visitor-related purpose for such a 50-mph freeway-type road, and (3) there are other prudent and feasible alternatives that would meet the transportation needs of the city without extraordinary costs and disruption and that are feasible from a design and engineering standpoint.

In addition, a number of American Indian groups have gone on record as opposing the Paseo del Norte project because of the impacts on lands that they hold sacred. The Paseo del Norte road corridor is still under consideration by the city, and unresolved issues about the road remain. Therefore, the road alignment is shown on

monument alternative planning maps as the Paseo del Norte study corridor.

The establishment of the monument by Congress and the signing of the binding agreement created the problems with the Paseo del Norte road corridor — not any actions recommended in this management plan.

Unser Boulevard and Paseo del Norte are discussed in greater detail in appendix D.

Federal and City Policies

Concerns have been expressed regarding potential conflicts with city and federal policies. The Park Service and the city are working together to resolve these conflicts. These conflicts were created by the passage of the monument legislation in 1990 and not by any recommendations in this general management plan. Where local laws and policies conflict with federal laws, federal laws take precedence.

The monument legislation is generally consistent with the *Albuquerque/Bernalillo County Comprehensive Plan* (City of Albuquerque 1988), the *Northwest Mesa Area Plan* (City of Albuquerque 1980a) and the *Northwest Mesa Escarpment Plan* (City of Albuquerque 1987). However there are differences of opinion regarding how to address the interpretation and implementation of some city policies such as the *Long Range Major Street Plan* (Middle Rio Grande Council of Governments 1993), which identifies Paseo del Norte with an alignment through the monument. It is beyond the scope of this plan to resolve conflicts with the *Long Range Major Street Plan* and federal law and policy.

Double Eagle II General Aviation Airport

The 4,700-acre Double Eagle II Airport, owned and operated by the Albuquerque Aviation Department, is immediately west of the monument. Built in 1983 as a general aviation reliever airport, the two runways and fixed-based operations primarily serve small general aviation aircraft. Ground access to the airport is via a two-lane road known as the haul road, airport access road, or Paseo del Volcan; however, the city has recently built a two-lane interim access road off of Paradise Boulevard that extends 5 miles to the airport's northern boundary. The Federal Aviation Administration has completed an environmental assessment for a proposed airport access road that would connect the airport to the city-built access road to the north.

The city began updating the master plan for the Double Eagle II Airport (Herkenhoff & Associates, Inc. 1980) in 1990. The purpose of this master plan update is to evaluate aviation-related opportunities and reassess airport development plans. The draft *Double Eagle II Master Plan Update* (Greiner Engineering, Inc. 1991) proposed significant expansion of airport facilities, including constructing two additional runways and lengthening an existing runway. Individual projects would be phased and developed on a demand-driven basis. The draft report states that the number of aircraft operations (takeoffs and landings) in 1990 was 51,100. Of the three forecast scenarios in the draft plan for 2010, the highest forecast is 311,350 operations, a sixfold increase in operations. The National Park Service has stated that an increase of this magnitude must be thoroughly evaluated and may have significant adverse impacts on the ability of visitors to appreciate the monument. The cumulative effects of individual airport improvements should be addressed in an environmental document.

Landownership

Approximately 1,315 acres of the monument, yet to be acquired, remain in private ownership. The National Park Service and the city will continue to acquire lands as provided for in the *Land Protection Plan* (National Park Service and City of Albuquerque 1991). As stated in the *Land Protection Plan*, lands currently owned by the city within the Atrisco unit will be donated to the federal government. The donation of these lands will be subject to future discussions and a memorandum of understanding between the Park Service and the city.

In addition, the *Land Protection Plan* also addresses the state trust lands within the Atrisco unit. According to the state constitution and related statutes, the state land office must receive fair market value for these lands. Because land owned by the state or local governments can only be acquired by the federal government through donation or exchange, the National Park Service will look to other federal agencies to exchange lands elsewhere in New Mexico for the state trust lands in the Atrisco unit. Because landownership, priority of acquisition, and interests in lands required to be in public ownership to meet the objectives of the monument legislation have been defined in the *Land Protection Plan*, it is unnecessary to cover these topics in this management plan.

SUMMARY OF RELATED PLANS AND PROJECTS

Several planning documents have been developed by the National Park Service, the city, Bernalillo County, the Albuquerque Metropolitan Arroyo Flood Control Authority, and private developers. Many of these have a direct relationship to the general management plan. The most

relevant policy-setting documents are described below; other related plans are described in appendix E.

Albuquerque/Bernalillo County Comprehensive Plan (City of Albuquerque 1988) — This is the overriding document governing planning activities within the urban area, and this plan provides a framework for other plans. The comprehensive plan recommends that new development west of the escarpment take the form of physically distinct yet politically integrated communities connected by high-volume traffic corridors.

Northwest Mesa Area Plan (amended through 1987, City of Albuquerque 1980a) — The plan covers a 207-square-mile area of the west mesa that includes the monument. The escarpment, volcanic cones, Rio Puerco escarpment, and the Rio Grande and Rio Puerco valleys are identified as areas to be protected. Large-scale mixed-use development is anticipated. This plan called for defining geographical boundaries for major public open space and developing buffer areas for development adjacent to major open space lands. The plan recommended considering a continuous pedestrian trail system.

Northwest Mesa Escarpment Plan (City of Albuquerque 1987) — This plan establishes concepts for developing and conserving the volcanic escarpment and immediately adjacent lands. Four resource areas are established for different degrees of conservation: (1) escarpment face — no development, (2) conservation area — preserving open space, (3) impact area — enhancement of the visual character adjacent to the escarpment, and (4) view area — regulating affected views from a distance. The plan provides for establishing a design overlay zone to address such concerns as height, lighting, color requirements, and building on a slope. The plan calls for the concentration of utilities and

roads to minimize damage to the escarpment, prescribes the preservation of the petroglyphs and other archeological sites, and identifies areas to be avoided by roads.

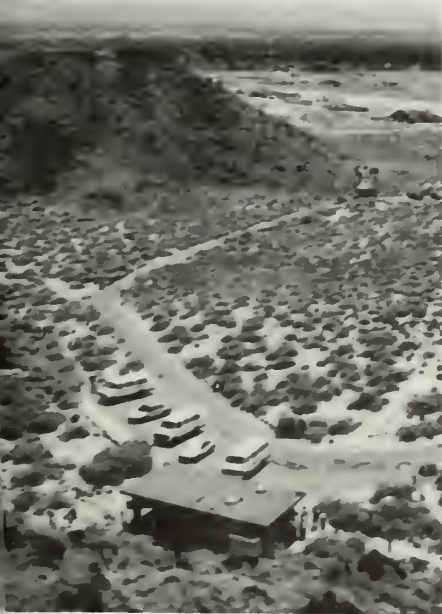
Land Protection Plan, Petroglyph National Monument (National Park Service and City

of Albuquerque 1991) — The National Park Service, the city, and the state have prepared a land protection plan completed in October 1991. A summary of land status is under "Landownership" in the "Issues Beyond the Scope of this General Management Plan" section.

PROPOSED ACTION AND ALTERNATIVES



Santa Fe Village



Boca Negra Canyon, visitor facilities



Boca Negra Canyon, developed trail



Petroglyph, Atrisco Unit

INTRODUCTION

With the aforementioned purpose and significance and management objectives in mind, four different alternatives — alternative 1 (the proposed action) alternative 2, alternative 3, and alternative 4 — for development at and use of the monument for the next 10-15 years are presented in this document. These alternatives describe different visitor experiences and different kinds and locations for facilities. Alternative 4, a no-action alternative, generally describes existing management trends. Current visitor use patterns would continue without developing major visitor facilities or programs. This alternative provides the reader with a

basis for comparing the other alternatives. The impacts of implementing each of these alternatives are presented in the "Environmental Consequences" section.

All alternatives have a common resource management approach because of resource management laws and policies that apply to various aspects of all national park system areas, including cultural landscape and archeological site values, natural resources, and various other aspects of monument management. The following section describes those common actions.

ACTIONS COMMON TO ALL ALTERNATIVES

PARTNERSHIP JURISDICTION, ROLES, AND RESPONSIBILITIES

From its legislative conception, Petroglyph National Monument has been viewed as a partnership park — a park in which both the National Park Service and the city Open Space Division would have a substantial day-to-day management role. The third partner, the state, has always been envisioned as having a role in land acquisition but a limited responsibility in land management.

It is assumed that the Open Space Division would continue to be the lead agency representing the city. Their organization supports operations throughout the city's open space network. Visitor and resource protection, administrative, and maintenance personnel would likely not be assigned specifically to Petroglyph National Monument but would instead continue to serve from a central pool servicing the overall open space program. The National Park Service would maintain similar responsibilities in the Atrisco unit.

Each agency would have a monument manager. Together they would be responsible for working out specific agreements to ensure the smooth and orderly flow of monument operations and management. The Park Service and the Open Space Division would continue their close working relationship through shared responsibilities and cross-training of staff.

The National Park Service would assume primary responsibility for cultural and natural resource management on a monumentwide basis and would be responsible for funding and operating the petroglyph research center. The city would assume primary responsibility for managing the Piedras Marcadas Pueblo ruin. The Park

Service and the city Open Space Division would work with city and county Land Use Planning and Permitting Divisions to ensure the coordination of review for developing adjacent lands.

As previously stated, federal laws that generally apply to units of the national park system shall apply to the monument. If there are differing interpretations of the application of federal laws, the NPS Southwest Regional Director (the secretary of the interior's designated representative to manage the monument) would determine the proper interpretation of federal law and policy.

Although the National Park Service has staff to manage Petroglyph National Monument, additional staff, as outlined in the later staffing sections, would be needed to manage and operate the monument under any of the alternatives. The city Open Space Division would also require additional staff and equipment to fulfill their responsibilities for monument management. The National Park Service and the city would develop formal agreements with American Indians and the Atrisco heirs concerning management and development issues.

CULTURAL RESOURCE MANAGEMENT

Cultural resources would be managed by implementing various policies, programs, and strategies, including education, continuing scientific study, inventory, evaluation, and consultation with American Indian groups and Atrisco land grant heirs.

An important concept to apply to managing the monument is "presence."

Presence is a management approach that demonstrates to visitors the significance of a site through subtle actions, such as directing and encouraging visitor compliance through interpretive signs, trail design, and low barriers, and more obvious measures, such as installing boundary fences and identification signs, putting visitor contact facilities at entry points, and stationing rangers near fragile, irreplaceable resources. Other approaches would be sensitive design, operation, and maintenance of facilities, which would demonstrate care and concern to the visitor. Interpretive programs and materials, law enforcement patrols, and regular maintenance all give messages to visitors that they should treat the area with respect.

Cultural resource management is comprised of several components including (1) inventorying, evaluating, and monitoring, (2) direct preservation, protection, maintenance, and stabilization actions, (3) protecting the cultural landscape, (4) research, (5) directing visitor use/designing and locating facilities, (6) law enforcement, and (7) educational and interpretive programs (including the heritage education program). The petroglyph research center/function would be an integral part of managing the cultural resources. No petroglyphs would be relocated or repositioned.

Cultural resources would be managed to provide the greatest degree of protection and preservation and to make all possible efforts to ensure that archeological resources would not be disturbed or removed. Monument managers would determine the optimum combination of the above elements and make modifications to address ongoing and changing visitor use patterns and resource management needs. Protection by directing visitor use/designing and locating facilities (5 above), law enforcement (6 above), and educational and interpretive programs (7 above) are also described in detail in their own

respective sections and in each alternative because they encompass more than the cultural resources; the other components (1, 2, 3, and 4 above) are discussed below.

Inventorying, Evaluating, and Monitoring

To manage effectively, managers must know what cultural resources are present within the monument and the integrity and significance of those resources. The first step in preserving and protecting cultural resources is inventory, followed by the evaluation of resource significance. Past and recent surveys of monument resources have identified the major cultural resources, including cultural landscapes, petroglyphs, and other archeological sites. Further inventories, including resource conditions, need to be conducted to ensure consistent coverage, techniques, and documentation. Following evaluation, any significant resources/qualified properties would be nominated to the National Register of Historic Places (or previously drafted nominations might be revised). Consultation with traditionally associated American Indian and Atrisco groups would occur before nomination of ethnographic resources.

A damage assessment survey is needed to document existing damage to sites and petroglyphs and identify areas vulnerable to vandalism, overuse, or damage from natural processes. This base data would be used to assess changes in resource condition. This information, and future information, would allow managers to further identify potential resource threats and respond effectively to minimize impacts of human use and natural processes upon resources. Some resource threats (e.g., vandalism to petroglyphs) are currently known, but the extent and sources of damage are not fully documented. The damage assessment survey would provide this information. Other actions are

proposed in this plan to address these threats.

Because cultural resources are nonrenewable resources, any degree of degradation is considered unacceptable. However, it is clear that change would occur through time and that some resource deterioration is inevitable. The monument staff would develop criteria for impact assessment and define unacceptable levels of change and key indicators of potential damage before adverse impacts occur — in consultation with the state historic preservation office and the Advisory Council on Historic Preservation. Such indicators would trigger remedial action by monument managers.

Direct Preservation, Protection, Maintenance, and Stabilization Actions

Conserving Petroglyphs. Extensive research would be required to conserve the petroglyphs. Where petroglyphs and rock surfaces have been vandalized by scratching, gunshots, or paint, a monitoring program and restoration plan would be prepared in consultation with recognized conservators and the Pueblo Indian community. The restoration plan would address priorities for graffiti removal and damage treatment and techniques that should be used. Priority considerations would be the visibility and extent of the vandalized surface, the proximity to other petroglyphs and to visitor use areas, and the likelihood that the vandalized surfaces would encourage additional vandalism. Two 1993 studies could serve as the initial basis for the monitoring and preservation plan: *Survey of Vandalized Sites* (McIntyre 1993) and *Assessment of Potential Conservation Methods to Remove Painted Graffiti* (Dean 1993).

Archeological Sites. Additional site-specific investigations would provide archeological and historical data as

needed. The Pueblo community would be consulted before development and other monument activities and programs that could adversely affect sites. If consultation or site monitoring indicates damage is occurring from human activities or natural processes, appropriate protective measures would be initiated promptly. The integration of natural and cultural resource management plans (e.g., fire management, vegetation management, and ruins stabilization) would ensure consistency in the treatment of resources.

For any ground-disturbing activities (including new construction, regrading, filling, revegetation, or removing structures), care would be taken to avoid sites and prevent damage to archeological or ethnographic resources. At the earliest possible stage of a proposed project (during project scoping or no later than development of the task directive), the state historic preservation office and the Advisory Council on Historic Preservation would be invited to participate in the development of conceptual and/or site-specific designs to ensure the best possible resource avoidance and preservation strategies.

Where impacts on resources cannot be avoided (e.g., site location constraints, vandalism, or erosion), appropriate investigations, documentation, and mitigation would be conducted to recover scientific data and mitigate effects.

Mitigation strategies might include collecting diagnostic artifacts, stabilizing surface features, recovering data, and monitoring construction activities. Mitigating measures would be developed in consultation with the state historic preservation office, the Pueblo community, Atrisco heirs, and the Advisory Council on Historic Preservation.

Resource damage from natural processes would be mitigated by data recovery or management actions. Erosion control or other mitigating measures would be used where natural processes threaten sites, especially on the volcanoes and along the escarpment.

Piedras Marcadas Pueblo Ruin. Further study of the Piedras Marcadas Pueblo ruin would be done to evaluate specific stabilization and management approaches. This study would address the management of the ruin, including different approaches to the research and interpretive potential of the site. Inventory and analysis of surface materials would be especially important to prevent further loss of information through unauthorized collection or inadvertent soil disturbance. The Pueblo community would be full participants in this study, which would be conducted in compliance with federal and state laws and policies. Only noninvasive techniques would be used to conduct archeological research and obtain information about the ruin until the completion of such a plan. The site would be completely fenced and routinely patrolled. The visually intrusive nonhistoric ranger residence would be removed when adequate protection is ensured.

Although excavation could be considered in the future, it would be preceded by the completion of a ruins management plan and concurrence from the Pueblo community, the Advisory Council on Historic Preservation, and the state historic preservation office. Further investigations and interpretive programs would be consistent with the ruins management plan.

Excavation is not recommended at this time because (1) of strong concerns by the Pueblo community, (2) further studies need to be done, (3) it is contrary to NPS policy (see 1988 NPS *Management Policies* (V:1-2), (4) an excavated pueblo is already

available for public viewing and interpretation in the Albuquerque area, (5) there is potential that burial sites would be disturbed, and (6) the purpose of national parks and monuments is to preserve resources, and opening the site would disturb and destroy materials and information and expose vulnerable features and artifacts to weathering and degradation (see appendix F for further explanation).

Museum Objects. Museum objects and natural and cultural resource collections, study collections, archeological materials, records of petroglyphs and sites, and other archival materials are included among the other monument resources to be preserved and protected. A scope of collections statement would be prepared to define the purpose, extent, and uses of monument collections and to provide a consistent approach among the partners to manage archeological artifacts, museum objects, records of petroglyphs, and natural resources specimens. A collections storage plan would be developed and could be part of or accompany a future collections management plan to identify acceptable options for management and care of these resources.

Monument managers would establish a prompt and effective notification system to contact and consult with concerned American Indian groups should burials associated with these groups be found (as is consistent with NPS *Management Policies* 5:13 and as required by the Native American Graves and Repatriation Act and its implementing regulations [43 CFR 10]). A NAGPRA implementation plan, which would include strategies to ensure discussions with Pueblo Indians regarding archeological investigations and inadvertent discoveries, would be developed. Monument managers would deal with discoveries of sensitive resources on a case-by-case basis, with an informed awareness of tribal concerns and following procedures outlined in NPS 28 *Cultural Resource*

Management Guideline and the Native American Graves Protection and Repatriation Act. For a discussion of ongoing consultation with American Indian and other culturally affiliated groups, see later "American Religious Freedom Act and Traditional Uses" sections under "Actions Common to All Alternatives" and the "Consultation and Coordination" section.

Ethnographic Resources. To prevent harm to shrines or intrusion upon traditional religious practices, the monument staff would work with Pueblo peoples to provide privacy for observing traditional religious activities. This could be accomplished by restricting visitor activities in selected portions of the monument or temporarily closing an area/areas. Monument managers would honor the wishes of American Indians regarding religious activities, consistent with the American Indian Religious Freedom Act.

Monument managers would ensure that proper care and respect are given to any sacred sites, objects, and burials, and that consultation with concerned local Pueblo Indians would precede archeological investigations. The identification of significant cultural resources would be followed by protective measures.

Monument staff would protect information provided by Pueblo people and Atrisco heirs and keep such information in confidence. Information would be shared with the public only with permission (NPS *Management Policies* 5:13).

Fencing. Fencing and identifying the monument boundary would help protect resources from vandalism or misuse. All public lands in the monument would be fenced with an unobtrusive, high-tensile, smooth wire fence. This fence is already in use in numerous areas of the monument to identify the monument boundary and prevent motorized vehicle access (see

Interim Fencing Plan for Petroglyph National Monument [City of Albuquerque Open Space Division and National Park Service 1991]). As needed, more restrictive fencing and other protection measures would be used to protect critical cultural resources and prevent unauthorized access.

Protecting the Cultural Landscape

Within the boundaries of the monument there are several distinct cultural landscapes that represent significant changes in both land use and management over the last several thousand years. A preliminary study of these resources identified several landscapes with potential significance for the National Register of Historic Places.

Components of the cultural landscape include views and vistas, natural features such as the volcanoes, special features including the petroglyphs, stone sheep corrals and holding pens, archeological sites, and vegetation patterns. All are cultural resources and would continue to be protected from disrespectful use and degradation and treated in a manner that shows respect for American Indian beliefs and previous uses of the land. More detailed information about the monument's cultural landscapes is in appendix G and the *Petroglyph National Monument Cultural Landscape Overview* (National Park Service 1994a). Several recommended studies relating to the cultural landscape are listed in appendix H.

Adverse impacts on the cultural landscape would be minimized by proper siting and design of new facilities to avoid intrusion on the landscape, disturbance of archeological resources, or adverse effects on ethnographic values. Revegetation programs would be coordinated with cultural landscape management to ensure the protection of character-defining landscape features.

Research

Petroglyph Research Center. Research would be an important part of the cultural resources management program at the monument. In the establishing legislation, Congress made provisions for research relating to the petroglyphs.

To provide for research relating to Rio Grande style rock art, undertake comprehensive evaluations of petroglyphs, . . . prepare interpretive programs that are sensitive to the concerns of the Indian and Hispanic peoples, and relate monument resources to other styles and forms of rock art, . . . the National Park Service . . . in cooperation with the University of New Mexico, other educational institutions, foundations, Indian tribes, and private entities shall establish a Rock Art Research Center.

This petroglyph research center would function as a focal point for the systematic and scholarly collection, analysis, study of conservation techniques, and dissemination of information relating to Rio Grande style petroglyphs and other petroglyph and pictograph forms within the region. The center would provide leadership, direction, and assistance for a broad interdisciplinary program of research, including ethnographic studies, petroglyph dating and comparative studies of petroglyph forms and styles, protection, resource management, conservation techniques, interpretive and educational approaches, and the integration of petroglyph research with other archeological research, sites, and cultural landscapes.

Center research, archives, and library materials would primarily be directed toward monument petroglyphs and archeological sites and petroglyphs managed by other units of the national park system within the region. The National Park

Service is also authorized to undertake research and assist in managing, protecting, and interpreting Rio Grande style petroglyph sites through cooperative agreements with (1) other agencies on public lands, (2) willing landowners, and (3) entities who own other lands.

Research done at the center would include (1) a list and map of various locations of Rio Grande style petroglyphs, (2) the ownership of the petroglyph sites and the condition of the resources, and (3) the protection options and types of technical assistance needed for the protection and care of these resources. The Park Service is also authorized to expend appropriated funds for research, site protection, and interpretive programs for sites not within the monument.

Center research data and information would be integrated into monument resource management and interpretive and educational programs and materials. The center would develop cooperative agreements with the University of New Mexico and other universities to encourage and stimulate interdisciplinary petroglyph-related research. The center would function as a clearinghouse for petroglyph related information that has been collected in the past as well as facilitate the communication of ongoing, state-of-the art research and journal publications.

The center would also house a research library of relevant books, periodical articles, papers, and reports as well as archival storage for slides and records of petroglyph sites. Research center archives and library materials would focus on monument-related resources, techniques, and methods; however, selected materials on similar sites throughout the world would also be included.

American Indian and Atrisco land grant heirs' involvement in the center would be essential not only to the ethnographic component of petroglyph research but also in developing information to be used in producing educational and interpretive materials. Some information collected through research may be sensitive to Pueblo peoples, and this information would not be shared with other researchers or the public.

The center staff would develop a research plan with priorities, costs, and strategy for accomplishing and using this plan to seek funding. This plan would allow for unexpected research projects. The following are examples of research projects that the center could facilitate and support:

- gathering more data on Rio Grande style — e.g., consensus on what constitutes the style, its geographic extent (regardless of land status), quantitative data, and ethnographic and archeological perspectives
- gathering more information on the non-Pueblo IV period monument petroglyphs
- dating the petroglyphs
- analyzing the connection between the archeological record and modern Pueblo peoples (ethnographic and ethnohistoric research)
- investigating, evaluating, and documenting site-specific protection, preservation, and management methods
- systems of reporting damage to petroglyphs
- integrating principles developed in other fields of conservation into petroglyph research and conservation
- proper documentation and life of archival materials (photos, videotapes, etc.)
- petroglyph recording techniques and approaches
- developing software and database and networking techniques that are applicable to petroglyphs
- developing and testing established and new conservation techniques, including techniques for removing or disguising the effects of vandalism

The center would take an active role in

- communicating and coordinating with site managers, researchers, educators, and American Indians
- researching current visitor patterns and alternative visitor management techniques
- developing and testing site and resource damage monitoring programs
- having American Indian authorities comment on the significance of the petroglyphs — and how to use or not use this information appropriately
- developing and using monitoring systems to detect unauthorized access
- establishing outreach to existing organizations (such as the American Rock Art Research Association and the American Institute for Conservation of Artistic Historic Works)
- establishing a private cooperating association for additional funding to support research mission, public education and involvement, and publication
- developing and evaluating educational materials, programs, and curricula for a variety of levels and target audiences

Research center staff would provide support for and coordinate and facilitate independent research being carried out by others.

Generally, visitors would not be directed to the research center; information about on-going research would be provided in the visitor center or through interpretive programs/materials. Researchers would

give occasional talks to demonstrate active areas of research.

Other Research, Studies, and Plans.

Other independent research projects would be guided through research design, which reflects monument management needs. Research would be coordinated with the petroglyph research center. Wherever possible, future cultural and natural resource inventories and research efforts would take advantage of a broad range of professional disciplines and to clarify the associations between natural and cultural resources in the cultural landscape. Various plans and studies would be implemented to guide the study, treatment, interpretation, use, preservation, and management of the monument's cultural resources. These are itemized in appendix H.

DIRECTING VISITOR USE/DESIGNING AND LOCATING FACILITIES

Visitors would be directed to sites and areas that can best accommodate use and would be discouraged or prohibited from areas where use would adversely impact or destroy sensitive natural or cultural resources. For more information, see discussions of interpretive and educational programs and law enforcement in later sections and throughout the management plan.

New facilities would be designed and sited to minimize direct impacts on petroglyphs and other potentially significant cultural and natural resources. It is especially important to avoid intrusion on the unobstructed views of the Sandia Mountains and the Rio Grande Valley.

Activities in petroglyph concentration areas would be focused on opportunities for visitors to see the petroglyphs in their context and within the cultural landscape. Only the development necessary to proper-

ly guide visitors and protect resources would be allowed. Picnic tables, restrooms, trash receptacles, etc., would be kept away from petroglyphs. Such separation of activity areas from petroglyph areas would focus visitors on the images and their context, which would help increase appreciation and respect for these resources.

Sensitive design of new visitor facilities in petroglyph viewing areas would be of vital importance to prevent adverse impacts. Archeological survey data would be used to site new facilities away from significant resources and avoid adverse impacts. Wherever possible, parking areas would be screened or physically separated from petroglyph viewing areas to diminish noise, exhaust fumes, and visual intrusions. Care would be taken to prevent visual and physical separation of petroglyphs from associated sites and landscape context.

Visitors would be required to stay on designated and improved trails. Off-trail climbing or hiking on the escarpment would not be permitted to prevent resource damage. Trails, perhaps with widened sections, and viewing areas would be designed to allow visitors to clearly see the petroglyphs while staying an appropriate distance away from the petroglyphs to prevent touching. Low subtle barriers or walls would be used in areas of visitor use; more obvious barriers or walls would be used in areas with more visitor use. Because trails might disturb relationships between petroglyph panels, to the greatest extent possible trails would not be designed between or through petroglyph concentrations.

Access from neighborhoods to the monument would be allowed only at designated points along the escarpment to protect monument resources.

In Albuquerque and most of the Southwest, flash floods are common occurrences. Visitors would be warned to stay out of all arroyos and drainage ditches in the monument.

Guided tours would be one method for visitors to gain appreciation for the petroglyphs while ensuring protection. Other approaches to be implemented would be to

- station a ranger near petroglyph concentrations to provide interpretation and protection
- use interpretive and resource protection messages on wayside exhibits (outside panels), trail brochures, and other interpretive media to support protection efforts
- issue permits to provide opportunities for solitude, communicate the importance of staying on designated trails, have a record of visitors using portions of the monument, and if necessary, control visitor numbers

Facility design would reflect cultural and natural values of the monument and have a common theme (see appendix 1) that would be repeated in all developed areas to link the overall visual image of the monument. Monument facilities (roads, trails, and other facilities), would be designed to direct the visitor's attention toward the monument's landscape, resources, and deeply rooted cultural heritage and away from the intrusive urban development encroaching upon the area. The goal is to encourage this attention with design consistency and visual quality that communicate a sense of place, including a reflection of natural landscape patterns in developed areas and minimal disturbance to ecological and cultural resources during design, construction, and maintenance.

Facility development would incorporate energy conservation measures such as timers and sensors for lighting, high efficiency insulation, passive solar heating, fresh air ventilation, using locally available materials, and maximum use of daylight. New designs should also be functional and include opportunities for flexible future use of facilities.

The development of designated trails in petroglyph viewing areas, across the escarpment, and on the mesa top would reduce impacts of multiple informal, social, trails by directing visitors on designated routes. Sites adjacent to trails would be protected by requiring visitors to stay on designated trails.

Wherever possible, new roads and trails would follow existing routes to preserve the cultural landscape and prevent new disturbance of archeological and natural resources. While preventing damage to archeological and natural resources, most existing informal trails and parking would be carefully restored; others would be improved for visitor use.

LAW ENFORCEMENT

Law enforcement would be used to ensure compliance with monument regulations. Rangers would actively patrol the monument, with special attention to petroglyph and archeological sites. Ranger presence would deter visitors from violating regulations and serve as an indicator that the regulations are being enforced. Unobtrusive law enforcement techniques, such as electronic sensors, could be used to supplement ranger patrols or to indicate when people are off trails in remote areas. For electronic devices to be effective, rangers must be available to respond. (Recommended staffing levels under each of the alternatives (except no action) are adequate to carry out these functions.) Law

enforcement staff would be trained to be sensitive to Pueblo religious and traditional activities. The monument staff would actively involve adjacent neighborhoods in a neighborhood watch program to help protect monument resources.

Monument rangers (NPS and city) would enforce city, state, and federal laws within the monument. The Park Service would pursue concurrent jurisdiction for non-federally owned portions of the monument for law enforcement purposes by federal officers. The city law enforcement rangers have the authority to enforce federal law on city-owned lands within the monument.

AMERICAN INDIAN RELATIONSHIPS, AMERICAN INDIAN RELIGIOUS FREEDOM ACT, AND TRADITIONAL USES

All public lands within the monument would be managed to comply with the American Indian Religious Freedom Act and related NPS policies. In carrying out this mandate, all monument programs would reflect informed awareness, sensitivity, and serious concern for the traditions, cultural values, and religious beliefs of American Indians who have ancestral ties to the monument. This policy includes

- developing means for reasonable access to sites with traditional, ceremonial, or religious significance (which may include temporary closure of some portions of the monument to prevent interference by non-Indians with such ceremonies)
- involving American Indians in the decision-making process where their traditions and cultural values would be affected by monument programs
- providing technical assistance
- participating in cooperative activities or programs related to American Indian

history, cultural traditions, or cultural resources

- training monument staff to be aware that the monument lands are significant to American Indians, that most of their religious practices are private, and that the American Indians have rights and needs
- providing opportunities and adequate time for American Indian groups to comment on development and visitor use plans that affect them

The Park Service would involve American Indians in current and future interpretive programs. This involvement could range from developing the programs to reviewing materials to presenting programs. The proximity of the monument to the Albuquerque metropolitan area has the potential for developing innovative programs that would reach a large, year-round audience.

Throughout and after the planning for this management plan, the Park Service and city representatives would continue to consult with American Indian groups regarding visitor use, archeological research, interpretive programs, and resource management for the monument. Formally, this consultation would be through the American Indian Consultation Committee, which is comprised of representatives from the All Indian Pueblo Council Inc., Five Sandoval County Pueblos Inc., Sandia Pueblo, Santa Anna Pueblo, and Zia Pueblo. Consultation with the Pueblo community would help avoid impacts on sacred sites, provide for continuance of religious activities, and help develop culturally sensitive interpretive programs.

Consultation is especially critical to reach mutually acceptable solutions to questions of resource preservation, interpretive programs, visitor use, and archeological research. All possible measures would be taken to resolve differences in a manner

that respects the cultural and ethnographic context of sites.

Monument staff would protect information provided by Pueblo people and Atrisco heirs and keep such information in confidence. Information would be shared with the public only with permission (NPS *Management Policies* V:13).

Traditional uses by Pueblo Indian groups with long-standing cultural ties to the monument might include a wide range of activities, such as gathering special herbs for healing or prayers at a special place. Such activities, rooted in the history of Indian communities, have been passed down from their ancestors and are important in maintaining the continuity of that community's traditional beliefs and practices. The continuation of the current levels of traditional use poses no threats to resources. Future requests for additional traditional uses within the monument would be decided in consultation among concerned groups and monument managers to ensure that there is no resource damage or use conflicts.

Monument managers would work with Pueblo groups to minimize interference with traditional uses, consistent with the American Indian Religious Freedom Act. Opportunities would be provided for American Indian groups to comment on development and visitor use plans in a manner that allows for the American Indian community to consider the proposals.

ATRISCO LAND GRANT HEIRS

The Park Service would continue to work and consult with the Atrisco land grant heirs to determine and document the nature and extent of any such traditional uses and how to maintain opportunities for such uses to continue. Consultation

with Atrisco land grant heirs would help avoid impacts on potential traditional use sites, provide for the continuance of potential traditional activities, and help develop culturally sensitive interpretive programs.

Throughout the discussion of the Atrisco heirs, the National Park Service is the responsible monument manager because the resources of interest to the heirs is entirely within the Atrisco unit (within the former Atrisco land grant).

The National Park Service would develop and execute cooperative agreements to ensure that the Atrisco heirs have the benefit of use and access to the monument. The National Park Service would protect traditional resources to the extent practicable. The location of sites would not be disclosed to the public.

The National Park Service would consult with the Atrisco heirs regarding planning, management, and operational decisions that affect materials and places or other ethnographic resources with which they are historically associated. Information about the outcome of these consultations would be available to those consulted.

NATURAL RESOURCE MANAGEMENT

Natural resources would be managed to

understand natural processes and human induced effects; mitigate the potential and realized effects; monitor for ongoing and future trends; protect existing natural organisms, species, populations, communities, systems and processes; and interpret these organisms, systems, and processes to the park visitor. Monument lands would be managed to preserve and enhance biodiversity.

Natural Resources Management Guidelines
(NPS 77, 1991 chap. 1, pg. 2)

Natural resource management programs and techniques would include (1) inventory and research (2) mitigation, (3) monitoring, (4) protection (5) interpretation and education, (6) administration, and (7) appropriate design of trails and facilities.

Inventory and research would be aimed at collecting baseline natural resource data for the entire monument, following up and concluding research activities that were begun before the designation of the monument, and identifying new research needs for natural resources. As part of the planning process for this management plan, natural resource data has been collected and consultation was conducted with the U.S. Fish and Wildlife Service, the New Mexico Department of Game and Fish, and the New Mexico Natural Heritage Program. A federal and state endangered and threatened plant survey was conducted in areas proposed for visitor activity and development. A soils map, habitat map, and general vegetation map were also prepared. However, more baseline data on resources such as soils, flora, fauna, hydrology, biodiversity, natural resource processes, and air quality are needed.

An inventory of the status of all natural resources would provide a baseline against which changes could be measured and assessed and appropriate management actions could be taken to preserve and enhance biodiversity. Limited and incomplete data could make management decisions speculative and could result in mismanagement, including the degradation or destruction of resources. Limited and incomplete data would also make it difficult to provide comment on actions occurring outside the monument boundary and their potential impact on monument resources. A *Resource Management Plan* (draft, National Park Service 1994b) has been prepared by monument staff to address critical resource needs and the

priority by which this information would be gathered and analyzed.

Mitigation measures would maintain existing natural processes or system components that might be threatened by human activities from within or outside the monument. Mitigation is also the conversion of a resource, altered by human activity, to a more functional or natural state. Mitigation includes preservation and restoration activities.

Monument lands are dominated by grasses, sagebrush, and desert scrub, which contribute to the overall natural character of the monument as well as its cultural landscape setting. It is important to preserve the natural vegetation of the monument lands in future development and revegetation efforts. The goal would be to revegetate disturbed areas — those already disturbed or those disturbed by future construction — to a plant cover that is consistent with surrounding natural vegetation. Using native plant materials commonly found in the monument would be emphasized and plants would be acquired either within the monument or commercially.

A successful native plant revegetation program depends on adequate information and testing for the appropriate mix of conditions relative to plant species, soils, climate, and degree of disturbance. A testing program should be developed to identify appropriate species, type of plant material (such as commercial seed mixes, collected seeds, sprigs, container grown, etc.), quantity, and level of manipulation for topsoil, soil ripping, mulching, and fertilizing. The results of the test plots would guide future decisions for revegetation in the monument.

The mesa top has many roads that have resulted from past ranching activities and recreational vehicle use. Many of these

roads and trails have created erosion and stormwater runoff issues on the mesa top. Except for those roads and trails required for public use, most of these would be closed and revegetated to prevent additional erosion and degradation of plant and animal habitat. Many trails and some roads that have developed in the canyons would require reclamation and revegetation.

An example of an area in need of restoration is Ladera Wash, which is an area in the monument that has been subject to grazing activity. This area would be revegetated using native, drought-tolerant species. Research would be conducted to determine if it is necessary to also restrict revegetation to the use of indigenous local species. The amount of area revegetated varies with each of the alternatives. Revegetation projects would be coordinated with the cultural landscape overview to ensure that significant landscape features are protected.

Monitoring, as defined by NPS 77 "is the systematic collection and analysis of resource data at regular intervals, in perpetuity, to predict or detect natural and human induced changes and to provide the basis for appropriate management response" (pg. 1:3). The collection of baseline inventory information combined with the initiation of a long-term monitoring program would alert management to changes in natural resource conditions that signal the need for a management action. Natural resources would be monitored and managed throughout the monument (as directed by NPS 75, *Guidelines for Natural Resource Inventory and Monitoring*), particularly in visitor use areas, to prevent adverse impacts.

A comprehensive monitoring program would be established for all trails in the monument. Monitoring would include identifying evidence of social trails (which

might indicate too much use on trails), trampled vegetation adjacent to trails, and exotic species habitat. If resource degradation were detected, management actions such as more active patrols, limiting the number of permits, and/or closure of trails and areas would ensure the protection of natural resources.

Protection is the prevention of overuse, vandalism, or destruction of natural resources by human causes and the enforcement of laws and regulations affecting natural resource management (NPS 77, 3:1). Rangers would actively patrol all visitor use areas, including the mesa top, to ensure that, regardless of their activities, all visitors would stay on established trails to avoid damaging natural resources. The use of a permit system to protect natural and cultural resources is discussed under each of the alternatives.

Education and interpretation would be used to explain the significance and value of the natural resources found in the monument, their relationship to the petroglyphs, their role in maintaining a healthy ecosystem on the west mesa, the existence of Chihuahuan desert species that are normally found much further south, and the habitat zones that are present within the monument.

The administration of monument resource management programs would be under the natural resources manager. This would involve planning, priority setting, allocating funding and staffing resources, contracting, training, and developing other activities that support resource management activities.

Appropriate trail and facility location, design, and development would ensure minimal adverse impacts on natural resources, including arroyos, floodplains, plants and wildlife and their habitats, and biodiversity.

These and other needed plans and studies related to the monument's natural resources that would be needed are listed in appendix H.

STORMWATER MANAGEMENT

Stormwater would continue to be allowed to enter the monument provided that the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) and the city's Hydrology Division use their authorities to regulate development and drainage improvements upstream of the monument that ensure stormwater coming into the monument does not derogate the values and purposes for which the monument was established.

Stormwater flows and effects on monument resources would be monitored, and control measures would be reviewed on a regular basis. Drainage plans that allow for the incremental addition or subtraction of upstream structures to/from the system would be evaluated individually.

The Park Service, the city, and the Albuquerque Metropolitan Arroyo Flood Control Authority would continue to work together to study stormwater flows, the characteristics of the drainage basins that effect the monument, and alternative management approaches.

INTERPRETATION AND THE VISITOR EXPERIENCE

Interpretation is an educational activity that is designed to stimulate curiosity, convey messages to the visiting public, and help the public understand, enjoy, appreciate, and protect the resources. The orientation aspect of interpretation is telling visitors where the visitor center is, what there is to see, how to get there, and where the restrooms are. But more

important is determining what visitors should learn about the monument — the interpretive themes — and how they would best learn that information — through media such as an audiovisual program, a wayside exhibit (an outside interpretive panel), a self-guiding brochure, a guided tour, or some other means. When determined, this is called the interpretive program for the monument.

Different approaches, media, and messages are needed for different groups and visitors. The media or methods are determined by analyzing likely audiences, considering what media work the best for each particular theme or message, and determining what kinds of developments would fit into the landscape and patterns of use. The details of interpretation — for example where the exhibits would be, what they would say, what the movie would describe, and what media should be used — would be in a future monument interpretive plan.

Interpretation is also an important means of protecting resources. The more visitors know about how special the resources are, the more inclined they are to respect and take care of those resources. Interpretive messages at the monument would convey this message.

Orientation

Under all alternatives, monument visitors would be directed to the visitor center or visitor contact facility to get basic orientation, interpretation, safety, and resource protection information before seeing the petroglyphs.

At the visitor center, visitors could learn about monument resources, activities, and policies as well as related area attractions, such as the Indian Pueblo Cultural Center, Coronado State Monument, the

Albuquerque Museum, the New Mexico Museum of Natural History, the Rio Grande Nature Center, city open space, parks and trails, nearby pueblos, and other national parks, monuments, and forests. Special emphasis would be given to areas that would complement the interpretive story of the monument. Orientation to services such as food, lodging, and other recreation opportunities would also be available in the visitor center, as would basic trip-planning assistance.

Visitor Experience

Under all alternatives, visitors would have diverse opportunities to see the petroglyphs and other monument resources. The range of opportunities would include

short, flat, hard-surfaced (wheelchair accessible) trails *to* longer, more "primitive" trails

guided programs *to* self-guided experiences

frequent, intensive onsite interpretation *to* no onsite interpretation

well-publicized opportunities *to* personal discoveries

short programs *to* extended/intensive seminars and workshops

unrestricted access *to* permits and previsit education

Visitors could only see the petroglyphs by pedestrian trails, and not all petroglyphs would be accessible to the public. Horses, bicycles, and dogs would not be allowed near petroglyph viewing areas in the canyons below the escarpment (except in escarpment trail crossing areas) because they could impair the experiences of other visitors, degrade the quality of the

contextual landscape, and adversely affect sacred areas. However, these activities could be allowed in designated parts of the monument where there is adequate space, where there are no petroglyphs, and where potential for damage to significant archeological sites is low. Visitors would be instructed to stay on designated trails, but they would have opportunities to hike by themselves on designated trails in various portions of the monument. Activities not directly related to petroglyph viewing may be linked to increased vandalism, as indicated by experience in other petroglyph areas in the Southwest. Monument trails and parking areas would generally be closed to use after dark.

Monument managers, through consultation with the Pueblo community, might restrict access to selected areas. Possible criteria include sacred importance and resource protection. Access might be restricted by not disseminating information and avoiding trail access.

Interpretation

A major component of the interpretive message would be to convey present-day American Indians' connection to the petroglyphs and the landscape to visitors. This message would include information that has been developed with the American Indian community about past and present cultures to give visitors enough information and experience to appreciate and respect the monument resources. Monument staff would also work closely with the Atrisco land grant heirs to develop interpretive messages that explain the historical changes in the use of the land and the lives of the people and communities that have evolved in the greater Albuquerque area. Activities, media, and facilities would encourage respect for Pueblo culture, rituals, and religion, including respect for privacy.

Important messages, including primary interpretive themes (described below) and resource protection concerns, would be repeated/reinforced in several ways and at several points during a visit. Various communication techniques would encourage maximum visitor cooperation in resource protection. Visitors would be told to stay on the designated trails, how petroglyphs and other resources can be inadvertently damaged, and the reasons for trails and barriers.

Many possible explanations for the petroglyphs could be given and would focus visitors on the significance of the petroglyphs rather than knowing exactly what the image means. These different perspectives would be presented as complementary and parallel rather than competing or mutually exclusive. Interpretation would not focus on individual petroglyphs but rather on the broader context and cultural landscape.

Monument managers, as allowed by applicable hiring regulations, would attempt to hire interpreters with Puebloan, Atrisco land grant heir, ethnographic, anthropological, and/or archeological backgrounds to provide these diverse perspectives. However, extensive consultation with the Pueblo Indian community and the land grant heirs would be required to determine what is and is not appropriate to share regarding the discussion of religious and cultural information by interpretive media and personnel.

Monument staff would protect information provided by Pueblo people and Atrisco heirs and keep such information in confidence. Information would be shared with the public only with permission (NPS *Management Policies* V:13). Active involvement of Pueblo and Atrisco land grant heir groups would be maintained to ensure quality interpretive programs and

media. Efforts would be made to develop programs and staffing to facilitate tours led by Pueblo and Atrisco people.

Personal services (storytellers, interpretive talks, and informal contacts) and audio-visual media (videos, slide shows, and audio recordings) would be used to convey complex and culturally sensitive monument themes.

Many topics could be effectively interpreted inside the visitor center, including area geography, Pueblo culture, the history of Hispanic settlement, stories from Pueblo and Hispanic traditions, and comparing Pueblo structures and petroglyphs with other pueblos, tribes, and time periods as appropriate. If appropriate, archeological items might be displayed in exhibits. Visitor center information could include Puebloan, Hispanic, and anthropological perspectives on monument resources.

Outdoor wayside exhibits at trailheads would guide activities, introduce important information, and interpret views and resources ahead on the trail. Waysides would be located near petroglyphs only in highly developed areas and only with sensitive placement and design. Wayside exhibits could provide effective interpretation of landscapes and contexts.

Every reasonable effort would be made to make the facilities, programs, and services of the monument accessible to all people, including those with disabilities. This policy is based on the commitment to provide access to the widest cross section of the public and to ensure compliance with the intent of the Architectural Barriers Act (42 USC 4151 et seq) and the Rehabilitation Act (29 USC 701 et seq.).

Outreach programs would provide educational and protection information to schools, adjacent neighborhoods, and other community and public interest

organizations. Programs would be developed, with cooperation from Pueblo and community groups, to involve adjacent neighborhoods in protecting the monument. Interpretive displays at parks, public libraries, schools, museums, and other areas where the public might gather would be designed to raise public awareness and communicate a message of respect and preservation.

Monument managers would explore opportunities to enter into cooperative agreements or contracts with Pueblo groups and nonprofit entities for interpretive services and assistance.

Primary Interpretive Themes

The primary interpretive themes for the monument were developed based on the purposes and significance of the monument and its resources. The primary interpretive themes do not include everything that could or should be interpreted in the monument, but they should include those ideas that are crucial to the visitors' understanding of the monument's importance and significance. Within those guidelines, the following four primary interpretive themes were developed for the monument. These primary interpretive themes would be conveyed under any of the alternatives described later in this document.

A variety of interpretive techniques would be used to present these themes. Techniques would vary from area to area but overall would include direct contact with monument ranger-interpreters, an audio-visual presentation, exhibits, outdoor panels, and publications that explain natural and cultural features found in the monument. The difference between the alternatives would be in the extent, place, and method that the themes are conveyed.

- **Petroglyphs (images inscribed in rock) and pictographs (images painted on rocks) and their contexts are expressions of peoples from prehistoric and historic times.** They are rare and irreplaceable symbols that continue to be important in people's spiritual lives. Most of the petroglyphs found at the monument date from A.D. 1300 to A.D. 1600; however, early Puebloan and historic images are also found. Petroglyphs can be appreciated from cultural, spiritual, and aesthetic perspectives.
- **Human settlement of the Rio Grande valley dates back at least 10,000 years.** Monument resources reflect this continuum of history and human adaptations to the largely arid but biologically diverse environment as well as settlement and transportation patterns, technologies, subsistence, and spiritual life.
- **The petroglyphs were made by — and have special significance to — American Indians and Hispanic settlers.** The petroglyphs and their settings have special spiritual meaning and importance to American Indians, especially the descendants of earlier inhabitants. Many of the monument's historic petroglyphs and structures (such as stone corrals) reflect Hispanic settlement and land use.
- **Petroglyphs and other archeological remains are irreplaceable and fragile resources.** Visitors can cooperate in their preservation by not touching or defacing images, leaving artifacts in place, and respecting the rights of other visitors.

Heritage Education Program

Heritage education programs are a top priority for the monument. Educational

programs are an excellent way to reach out to audiences who have had little previous access to monument resources, programs, and values. The monument is within the Albuquerque city limits, and more than 89,000 students (54% are minorities) attend the public schools. There is a strong tradition of educational programs at the Boca Negra Canyon unit, which has been conducted by the city Open Space Division; in the last three years NPS interpreters have shared in the interpretation. Teachers and school administrators show strong interest in these programs, and there is considerable interest in expanding educational partnerships.

The monument's resources and interpretive themes correspond both to school curricula and to contemporary issues affecting neighboring populations. The educational program would allow the opportunity to further the goals and mission of the National Park Service and Petroglyph National Monument management policies (see appendix B) as well as to serve the needs of students and other citizens.

Effective educational programs would require some investment in facilities, interpretive media, and personnel. Outreach programs would be an important part of the educational effort, but they would not be a replacement for a site visit; there is no substitute for direct experience with monument resources. The most effective programs would have both indoor and outdoor components; many introductory and preparatory activities and interpretive media programs would not work on trails and would require indoor space. For these reasons, all alternatives call for a heritage education facility or function. Monument staff would explore partnerships with industry and local educational institutions to fund and cooperate in implementing these programs.

Circulation

Possible Shuttle System. To provide direct and efficient access to the monument, a shuttle bus system would be considered for connecting the visitor center, in whatever location, with other facilities/areas of interest to visitors. Such a system would be evaluated and, if feasible, implemented as visitor use and demand increases. The visitor center area could be used as a central parking and staging area where visitors could get on the shuttle buses. Options that use the regional transit system would also be evaluated.

Other Ways to See the Monument. An alternate means for national visitors to understand, appreciate, and enjoy the monument could be to go on tours given by the Indian Pueblo Cultural Center. Guided tours from the center in Albuquerque would encourage cultural center visitors to visit the monument and learn more about past and present American Indian cultures. The city has also recently initiated a cultural center shuttle to connect Albuquerque museums and cultural centers. This shuttle or a separate shuttle could also connect with the monument visitor center.

CARRYING CAPACITY AND VISITOR IMPACT MANAGEMENT

As the number of monument visitors increases, the potential also increases for visitors to damage cultural and natural resources and/or alter the experiences the monument offers. It is therefore important (and required by NPS *Management Policies* and the General Authorities Act of 1978 [PL 95-625]) to address the concept of carrying capacity — which is defined as the type and level of visitor use that can be accommodated while sustaining the desired resource and social conditions that

complement the purposes of the park units and their management objectives.

Although the Park Service is currently developing a visitor experience and resource protection process for addressing carrying capacity, the implementation of an approved carrying capacity methodology is several years away. However, some steps have been defined that are being used in selected national park system areas to begin to address carrying capacity. Briefly, the steps are

- identify management zones and desired resource and social conditions
- devise management strategies to achieve the desired conditions
- identify key impact indicators and standards for each zone, which can measure whether or not the desired conditions are being met
- analyze existing conditions with respect to desired conditions and identify probable causes of discrepancies
- refine management strategies based on this analysis
- implement a program of continuous monitoring and evaluation to ensure that desired conditions continue to be achieved

This management plan provides a basis for beginning to address the monument's carrying capacity. The plan identifies general management goals and strategies and management zones — the first two steps above. Specific desired conditions and key impact indicators still must be identified in future studies, and desired conditions should be compared with existing conditions. Adopting the above approach to carrying capacity would also require the monument staff to establish monitoring and evaluation procedures to

ensure that acceptable resource and social conditions are achieved and maintained. Until further studies are completed, staff would monitor monument resources and visitor use to establish baseline conditions and watch for impact trends. If unacceptable impacts become apparent, monument managers would take actions to restore conditions to acceptable levels.

BOUNDARY ADJUSTMENTS CONSIDERED AND RECOMMENDED/NOT RECOMMENDED

Boundary additions specified in the legislation for the 59-acre Lava Shadows area and the 24-acre area just south of Boca Negra Canyon were completed in June 1994. During the general management plan public meetings and through discussions with the Petroglyph National Monument Advisory Commission and others, the following other areas (see table below) have been discussed as possible boundary adjustments.

In accordance with NPS *Management Policies* and Public Law 101-628, sections 1216 and 1217, the Park Service must apply five conditions or reasons as criteria to evaluate proposed changes to existing boundaries of units of the national park system. The criteria and evaluation for boundary adjustments are detailed in appendix J; a brief summary is provided below for the boundary adjustment areas listed above. The adjustments listed above are recommended under all alternatives, with the exception of the Cohen property for which no action is recommended. Two additional boundary adjustments are recommended, one under alternative 1 and one under alternative 2; they are described under those alternatives.

TABLE 1. BOUNDARY ADJUSTMENT AREAS

Recommendation	Location/Size	Alternative
Deletion	Single-family house and lot at the end of Creggs Street at the northern edge of the Atrisco unit — less than 0.33 acre.	All
Modification at a later time	Lots in Volcano Cliffs Units 2 and 5 that have potentially lost access due to the way that the legislative boundary was drawn — acreage to be determined later	All
No action	Harold Cohen property — single-family house and lot within the current authorized boundaries of the monument — 2.21 acres.	All
No action	Areas adjacent to Piedras Marcadas Pueblo ruin	All

Single-Family House and Lot

The inclusion of this house and lot within the existing authorized boundaries was an oversight in the initial boundary mapping process. It is the last house on a street with seven houses abutting the monument. This property does not include significant resources or opportunities for the public to further enjoy monument resources and does not fulfill any monument purpose, and it should be removed from the monument boundary.

Volcano Cliffs Units 2 and 5

In drawing the existing monument boundaries, a portion of Rim Rock Drive and lots on either side of this roadway were included within the monument. However, the closure of Rim Rock Drive as envisioned by each of the alternatives would eliminate access to approximately 54 lots in the Volcano Cliffs community.

Some of these lots must be acquired to provide access. The National Park Service would work with affected landowners, the Volcano Cliffs Property Owners Association, and the city to ensure that access would be provided to these lots. Given

several alternatives and the need to consult further with affected parties, it is premature to recommend a specific solution or adjustment at this time.

Cohen Property

This 2.21-acre property, within the monument, contains a single-family residence, swimming pool, a sweat lodge, a Buddhist prayer wheel, a stupa (shrine), and storage outbuildings. The property owners requested a boundary adjustment to exclude their property from the monument. The approved *Land Protection Plan* (National Park Service and City of Albuquerque 1991) recommends the fee simple acquisition of this property to protect the integrity of the area. Since the approval of the *Land Protection Plan*, the federal government has acquired adjacent structures and converted two of them to the interim visitor center and staff offices. Nearby NPS facilities and other structures would be removed when no longer needed to restore the integrity of the escarpment. When these NPS structures are removed, the structures on the Cohen property would be the only remaining structures and therefore would be visually intrusive.

It is not recommended that a boundary adjustment be made.

Piedras Marcadas Pueblo Ruin

The National Park Service has been working with the city to determine the best approach to protecting the ruin and providing for visitor use. The acquisition by the city of the 23.5-acre site south of the ruin has provided new opportunities for access to and visitor use of the site. Because of these new opportunities and existing and proposed adjacent development, it is likely that the current 2-acre site on the west side of the drainage channel might not be used for an NPS visitor contact facility as had originally been intended.

The National Park Service and the city are working together to further define the extent of the archeological site that is beyond the current monument boundary and to evaluate the current level of protection and significance of the areas outside the monument boundary. These ongoing discussions will determine future boundary adjustment needs and the various options for visitor contact and use of the site. The 2-acre site northwest of the ruin is being considered for deletion from the monument, which would require a boundary adjustment. A portion of the city lands to the south, which include a portion of the ruin, could be added to the monument. Other lands with monument-related resources adjacent to the ruin could also be considered for addition to the monument.

Future Boundary Adjustments

Future boundary adjustments would be considered for any lands adjacent to the

monument boundary that meet the criteria in appendix J. In addition, boundary adjustments would also be considered if additional lands are required for public access to areas within the monument with high potential for visitor use and as studies are done of Rio Grande style petroglyphs throughout the Rio Grande valley (as mandated in the monument's establishing legislation). Such modification, for this or other reasons, would be consistent with NPS policies and regulations.

Where a boundary adjustment appears to be appropriate, the National Park Service would recommend it to the secretary of the interior for legislative or administrative action. Congressional action is required for boundary adjustments; however, in some cases the secretary may make minor boundary adjustments where authorized by existing law without additional congressional action (*NPS Management Policies II:9*).

OPERATIONS

Monument facilities would be managed for day use. Overnight facilities would be provided outside the monument by private businesses.

The National Park Service and the city Open Space Division would concentrate on providing opportunities to meet essential visitor experience objectives. Limited resources (such as staffing, funding, space, and locations for development) would be directed toward providing essential experiences — such as seeing the petroglyphs in context. Activities that threaten monument resources or interfere with other visitors' experiences would not be encouraged or permitted.

MONUMENT FEE DETERMINATION

After carefully reviewing the criteria for establishing fees in national park system units in the Land and Water Fund Conservation Act (see appendix K), it has been determined that Petroglyph National Monument, as planned in any of the various alternatives, does not lend itself to establishing a fee collection program. The numerous access points and visitor use facilities create a particularly difficult obstacle to fee collection. Furthermore, there are no special uses or activities for which recreation use fees would be appropriate.

The Park Service wants as many visitors as possible to go to the visitor center and learn about the resource management and protection messages that are part of the center's program. Possibly restricting access because of an entrance fee would be counterproductive. Consistent with this reasoning, the city's existing fee collection program at the Boca Negra would be discontinued.

UTILITY RIGHTS-OF-WAY

As lands adjacent to the monument are developed, requests for monument managers to locate utility rights-of-way across the escarpment will occur. Requests for rights-of-way for water, sewer, electricity, telephone, cable television, and stormwater control structures will be reviewed on a case-by-case basis. However, there must be specific statutory authority for granting such rights-of-way and there must be no feasible or practicable alternative, even if the costs are higher. Furthermore, the use must be compatible with the public interest and not a derogation of monument values, resources, and purposes.

The authorities for issuing rights-of-way are contained in 16 USC 5, 16 USC 79, and

NPS 53 *Special Park Uses*. Rights-of-way issued by the National Park Service permit access for construction, operation, and maintenance of facilities but do not grant any interest in land and are revocable at the discretion of the director.

Before approval of utility rights-of-way, compliance with the National Environmental Policy Act and section 106 of the National Historic Preservation Act is required. The applicant must be prepared to implement appropriate mitigation measures such as low-impact construction techniques, corridor location, and underground installations, including underground powerlines.

PLANNING AND TECHNICAL ASSISTANCE FOR ADJACENT LANDS

As provided in section 106 of the monument legislation, the National Park Service would participate in land use and transportation planning for lands adjacent to the monument and might provide technical assistance to local authorities and affected landowners for such planning. NPS efforts would be directed to activities that could have adverse effects on monument resources and visitor use, such as activities that could have high noise levels, adverse visual impacts, or introduce plants or animals that could adversely affect the biodiversity of the monument.

The Park Service and city Open Space Division staff would continue to work with adjacent residents to minimize any such adverse impacts.

ACCESSIBILITY FOR VISITORS WITH DISABILITIES

For visitors with disabilities, the highest level of accessibility possible would be provided to buildings, facilities, programs,

and services; accessibility would be consistent with the nature of the area, the conservation of monument resources, and the preservation of a quality experience for everyone. Buildings, sites in developed areas, and primary interpretive trails would be designed and constructed or rehabilitated in accordance with *Uniform Federal Accessibility Standards* (49 FR 31528) to provide full accessibility to visitors with disabilities. Due to steep terrain, remote trail location, and other constraints dictated by the environment, it would not be possible to make all facilities, programs, and services available to all people at all

times. Trails to more distant and remote portions of the monument would not be constructed to be fully accessible. Trails near roads, buildings, and overlook areas would be fully accessible.

All interpretive programs, activities, publications would be provided so that visitors with disabilities receive as close to the same benefits as nondisabled people. Individuals and organizations for disabled persons would be consulted to ensure that facilities and programs are designed to provide maximum accessibility where terrain and protection of resources allow.

ALTERNATIVE 1 — PROPOSED ACTION

INTRODUCTION

The overall approach of the proposed action (preferred alternative) would be to provide various ways for visitors of different ages and abilities to see and appreciate many of the monument's significant resources (see Alternative 1 map). Visitors would be directed to a new visitor center at Boca Negra Canyon where they would have opportunities to learn about the significance of the monument resources and past cultures that have lived in the region, as well as have easy access to numerous and various petroglyph viewing areas. This alternative focuses visitor activity on seeing the petroglyphs within the context of the escarpment, mesa top, volcanoes, the Rio Grande valley, and the Sandia Mountains.

Horse and bicycle riding would be allowed on designated mesa-top trails away from petroglyphs and archeological sites. Permits would be required for trail use. Mesa-top resources and visitor experiences would be monitored to identify adverse impacts and needed action. Parking would be provided at Mesa Prieta and Rinconada, Boca Negra, and Piedras Marcadas Canyons, with short trails at each area that would accommodate people of all ages and abilities. Mesa-top panoramic viewing areas would be provided at Mesa Prieta and near the end of 81st Street and at the volcanoes. There would be several access points to the monument but few opportunities for a remote or isolated experience.

PARTNERSHIP JURISDICTION, ROLES, AND RESPONSIBILITIES

Under this alternative, the city Open Space Division would be chiefly responsible for visitor services, visitor and resource pro-

tection (law enforcement), and maintenance operations in the Piedras Marcadas unit. The city would have responsibility for staffing facilities and programs in the Piedras Marcadas unit, and the city and the Park Service would share responsibilities in the Boca Negra unit, including the visitor center.

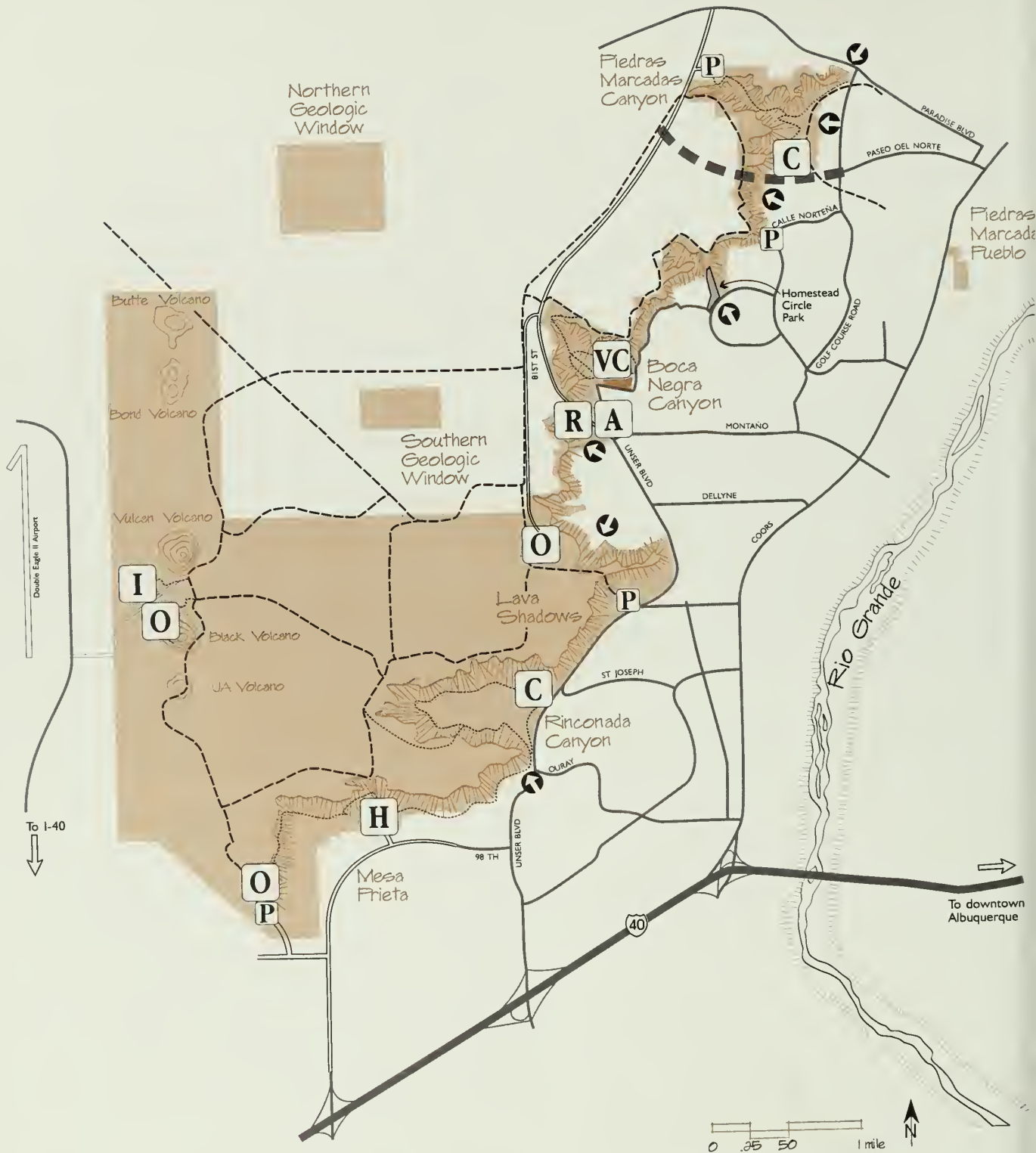
MANAGEMENT ZONING

NPS *Management Policies* (NPS 1988) state that general management plans prescribe a system of management zones to designate where various management strategies would be implemented to achieve the purposes of the monument. Management zones indicate how resources, visitors, and developments would be managed within different parts of the monument. Subzones are used to focus management on specific types of protection, use, or development.

The monument would be divided into three zones: natural/cultural, development, and transportation (see Management Zones map). Management zones are prepared for the proposed action only. Private lands that would be acquired by the federal, state, or city governments have been zoned to indicate the future management approach to these lands if and when they are acquired. The proposed management zones would not restrict or regulate private lands in any way.

Natural/Cultural Zone and Subzones

The natural/cultural zone would be managed to preserve and interpret cultural resources and natural resources and processes. These resources would include the cultural landscape, which has value and significance because of the importance



Alternative I

Petroglyph National Monument

United States Department of the Interior
National Park Service
DSC • August 95 • 354 • 20,005

Alternative I



Boca Negra Canyon

- visitor center
- interim heritage education facility

Piedras Marcadas Canyon

- visitor contact facility

Piedras Marcadas Pueblo Ruin

- visitor contact facility

Rinconada Canyon

- visitor contact facility

Mesa Prieta

- future heritage education facility*
- overlook and parking

South of Boca Negra Canyon

- administration
- petroglyph research center

Java Shadows

- trailhead and parking

Volcanoes

- visitor information kiosk
- overlook

Geologic Windows

- no development
- occasional guided tours

1st Street

- overlook and parking

Homestead Circle Park

- pedestrian trail and seating area

The development of this facility depends on future needs.



visitor center



visitor contact facility



visitor information kiosk



administrative facility



heritage education center



petroglyph research center



overlook



parking area



neighborhood access



Petroglyph National Monument



escarpment



foot trail



multiuse trail



boundary addition



Paseo Del Norte study corridor



proposed paved road





0 .25 50 1 mile



Management Zones

Petroglyph National Monument

United States Department of the Interior
National Park Service
DSC • August 95 • 354 • 20,012

- natural/cultural zone
includes most of monument
- mesa top and flats subzone
- sensitive resource subzone
- solitude subzone
- development zone
- transportation zone
- escarpment

that Pueblo Indian people and Atrisco land grant heirs have for the area and which includes the area's natural features, plants, and animals. This zone would include most lands above and below the escarpment near existing and proposed residential areas. This zone would be a quiet area in contrast to the nearby urban landscape and would be managed to protect its inspirational, cultural, and natural values while allowing for designated trail corridors along existing dirt roads. All visitors would be required to remain on designated trails. This zone would be managed for a moderate level of visitor use.

The **sensitive resource subzone** would also include quiet areas that contrast with the nearby urban landscape and would include the geologic windows, the escarpment, the Piedras Marcadas Pueblo ruin, and all the volcanoes except Black Volcano, which has been adversely impacted by past mining activity. General visitor use in these areas would be restricted because of the physical limitations of these areas to withstand unrestricted public use, the research potential of the areas, and their significance to the American Indian Pueblo community.

The **mesa-top and flats subzone** would include the mesa-top lands with their valuable wildlife habitat, opportunities to study volcanic processes, numerous archaeological sites, value to the Pueblo Indians, and vast open views of the volcanoes, the escarpment, the Sandia Mountains, and other landscape features. This subzone would also include most lands below the escarpment near existing and proposed residential areas.

The **solitude subzone** would be managed to provide a sense of solitude through the use of permits and/or trail design. Because it is difficult to see the city or other development from these areas, and because of

the sense of enclosure, these areas provide a sense of solitude.

Development Zone

The development zone would be managed for the development of visitor and administrative facilities and structures. These facilities would include a visitor center, a heritage education center, a petroglyph research center, visitor contact facilities, parking and picnic areas, and overlooks.

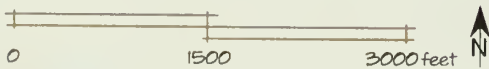
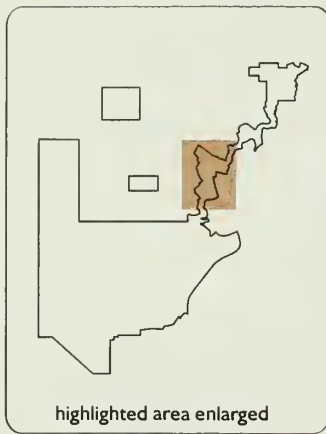
Transportation Zone

The transportation zone would include the Unser Boulevard development corridor through the monument, which is proposed by the city.

VISITOR CENTER — BOCA NEGRA CANYON

The visitor center at Boca Negra Canyon would be the primary visitor destination. Here visitors would learn about the significance of this national monument, the petroglyphs and their context, their fragility, their significance to present-day Pueblo Indians, and current related research. Orientation to the visitor services and facilities, monument, metropolitan area, petroglyph areas, and related sites would be provided through brochures, maps, exhibits, and a staffed information area (see Boca Negra Visitor Center Site Concept Plan). Congressional authorization would be required for the expenditure of federal funds for developing the visitor center and related facilities.

As visitors approach and enter the visitor center, most should have impressions that the building is unobtrusive, welcoming, and compatible with the cultural landscape



Boca Negra Canyon Development Concept Plan

Petroglyph National Monument

United States Department of the Interior
National Park Service

DSC • August 95 • 354 • 20,016

-  development zone
-  proposed foot trail
-  proposed multiuse trail
-  Petroglyph NM boundary
-  proposed boundary adjustment
-  topography
-  existing drainage

and monument values. The center design, including entry and exit roads and parking, would give visitors a feeling of transition to and from this cultural landscape. The design of the facility and media within would encourage respect for the resource and the monument story. (See appendixes I and L for further information about design guidelines.)

Visitor activity areas would include a lobby and information area; exhibits; an auditorium; a multipurpose room for meetings, demonstrations, and other activities; offices and work areas for visitor center staff; storage; restrooms; and an outdoor plaza. Curatorial storage and a staff library would be accommodated in the petroglyph research center (described below).

The visitor center would also serve as an interim heritage education facility (see description below). The multipurpose room would serve as a classroom for these interim heritage education activities. Heritage education programs would include indoor and outdoor activities and would relate both to the primary monument themes and school curricula.

The auditorium would be designed for video and slide and film presentations and talks about monument resources. It would have a sloping floor (with flat areas for wheelchairs), fixed seating for about 75 people, good acoustics and stage lighting, a backstage area (for program preparation, costumes, etc.), and a projection booth.

Interpretive and educational items, such as maps, handicrafts, and other objects directly related to the interpretive and educational themes of the monument and the national park system would be sold by a cooperating association (currently the Southwest Parks and Monuments Association).

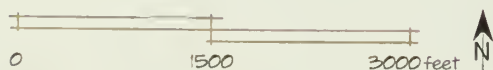
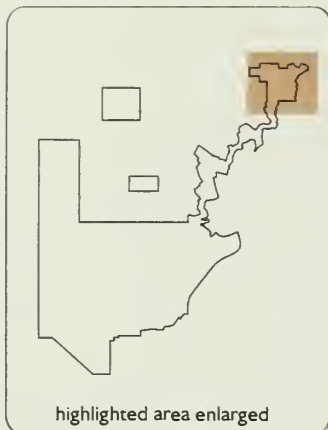
With the redesign and additions to the existing trail system (described below), petroglyph viewing areas, and associated exhibits, visitors would be able to walk on interpretive trails of varying lengths and difficulty from the visitor center to see petroglyphs in Boca Negra Canyon and along Staghorn Drive. (Access to the petroglyphs along Staghorn Drive would be by pedestrian trails from the Boca Negra Canyon area, not from Staghorn Drive.)

Exhibits would contain additional information and emphasize the protection of the petroglyphs and other monument resources. At least one trail would be accessible to visitors of all ages and abilities. The trail redesign would include a connection to the city's proposed recreational trail, which will follow the existing Unser Boulevard alignment. Bicycle racks and horse tie-ups would also be provided near the center but away from the escarpment and petroglyphs.

VISITOR CONTACT FACILITIES

Piedras Marcadas Canyon

Piedras Marcadas Canyon would most likely be visited by city/area residents who are repeat visitors to the monument and national visitors who wanted to see more of the monument and its petroglyphs. Primary access to the canyon would be from Paseo del Norte, where a short access road would lead to a small parking area (about 15 cars and 5 spaces for oversize vehicles) and visitor contact facility and restrooms (see Piedras Marcadas Canyon Development Concept Plan). This facility would be designed to provide orientation and information whether staffed or unstaffed (which would depend on visitor demand and staff availability). Visitors could see exhibits and information in and near the contact facility



Piedras Marcadas Canyon Development Concept Plan

Petroglyph National Monument

United States Department of the Interior
National Park Service
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- development zone
- proposed foot trail
- proposed multiuse trail
- Petroglyph NM boundary
- topography
- existing drainage

before going on trails to see the petroglyphs.

A pedestrian trail would go into the inner canyon along the base of the escarpment; the initial part of this trail would be hard-surfaced and accessible for people of all ages and abilities, but would become a more primitive, softer-surfaced trail. This trail would allow visitors to see the petroglyphs with a greater sense of solitude and quiet. If visitor use increases beyond the carrying capacity in the inner canyon, a permit system would be implemented to ensure the preservation of the natural and cultural resources as well as to provide opportunities for visitors to enjoy the area with fewer people around.

Other pedestrian-trail-only access opportunities to the canyon would be from designated access points in the northeast corner of the monument and a 10-car parking area (accessed from the proposed Unser Boulevard segment) in the northwest portion of the monument.

A pedestrian, bicycle, and horse trail would be developed along the eastern edge of the monument boundary connecting Paseo del Norte (and the contact station) with the northern portion of Golf Course Road (about 100 yards south of Paradise Boulevard).

Piedras Marcadas Pueblo Ruin

The National Park Service is working with the city to decide how to access the site and where facilities would be. One possibility is for the city to develop and manage a visitor contact facility south of the ruin and monument land. This facility would have office and interpretive space, restrooms, and a parking area. The lands south of the ruin have higher values for visitor use. This southern visitor contact area allows easier access from Coors

Boulevard and provides better views of the Bosque and the Sandia Mountains. The story of the monument could start where the people lived, in the Bosque. The combined functions would enhance the city-NPS partnership.

Themes to be interpreted would be American Indian daily life during the active period of the pueblo and the connection of the Pueblo people to the escarpment and the Bosque (the river and its bottomland vegetation). Interpretation at this site would explain noninvasive archeological investigations and reasons why excavation is not being conducted at this time. Monument heritage education functions could be combined with city environmental education programs. An interpretive trail would be developed to allow visitors to see the pueblo ruins while preventing damage or increased risk of vandalism. Visitors would be required to stay on the trail. As stated before, further study and consultation would be required before any excavation. This site would be open only when staffed to further reduce chances of vandalism, destruction, and theft.

A proposed multiuse (pedestrian, bicycle, and horseback riding) trail would connect the contact facility with the city's Bosque trail system, Los Metates, Piedras Marcadas Canyon, and the mesa-top trails.

The city's interest in developing the site is in the conceptual planning stages. The Park Service will continue to work with the city.

Rinconada Canyon

Rinconada Canyon would be accessible only on pedestrian trails from a small parking area (15 cars and 5 oversize spaces) and visitor contact facility (which would be staffed or unstaffed depending

on need) near the intersection of St. Joseph Drive and Unser Boulevard (see Rinconada Canyon Development Concept Plan). The entrance to the parking area would allow access only from southbound Unser Boulevard. Visitors traveling north on Unser Boulevard could not make a left turn from the intersection of Unser and St. Joseph, which would encourage visitors to go to the visitor center first and learn about the monument and its resources. The contact facility interpretive information could be in an open-air or enclosed structure, and restrooms would be available.

A pedestrian trail would be designed along the base of the escarpment into the canyon; the first 0.5 mile would be hard surfaced for visitors of all ages and abilities. Beyond this 0.5-mile point, the trail would be a marked but softer-surfaced path. The inner canyon visitor would see the petroglyphs with a greater sense of solitude. If visitor use in the inner canyon increases beyond the carrying capacity of this sensitive area, the number of visitors would be regulated by a permit system. This would ensure the preservation of the natural and cultural resources as well as the visitors' opportunities to enjoy the area with fewer people around.

There would also be a connecting pedestrian trail to the mesa-top trails from Rinconada Canyon.

HERITAGE EDUCATION CENTER AND OVERLOOK — MESA PRIETA

As heritage education programs increase and if conflicts occur in or near the visitor center at Boca Negra Canyon between educational groups and visitors, a heritage education center would be constructed south of Rinconada between Mesa Prieta and Unser Boulevard, near the existing water tank (see Mesa Prieta Development

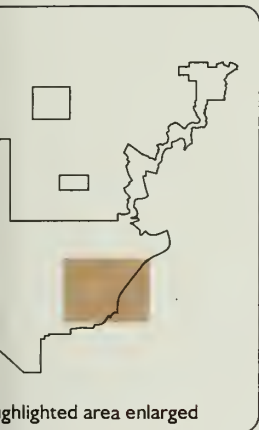
Concept Plan). The proposed site would be in an archeologically sensitive area. In site design, every attempt would be made to avoid direct impacts on archeological resources. If archeological resources cannot be avoided, a new construction site would be identified, in the same general area or elsewhere, through a site selection study. This study, and appropriate compliance, would be developed in concert with American Indians, Atrisco heirs, and the public.

The National Park Service and city would work to develop partnerships with other public institutions, private industry, and nonprofit organizations to assist in funding and operating the center.

Activity areas in the center would include two large activity/classrooms, each accommodating up to 80 students and 20 adults. These rooms could be divided by acoustic barriers to allow the presentation of four programs at once. Although each would have windows, the rooms could be darkened for audiovisual programs. Other activities would include a reception/orientation area, bookstore, offices and work areas for center staff, storage, a small kitchen, and group lunch areas (both indoor and outdoor).

Programs at the center would focus on monument themes and related topics such as cultural diversity, social issues, the cultures of the southwest, natural resources, human adaptation to the environment, and resource stewardship. School programs would also relate to school curricula. Most programs would have both indoor and outdoor components. Efforts would be made to reach out to groups who previously have made little use of the monument.

Although most use would be by scheduled groups, some nongroup public interest and visitation would be anticipated. The reception area would be used to greet

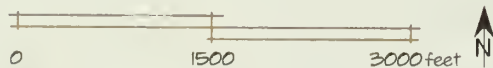
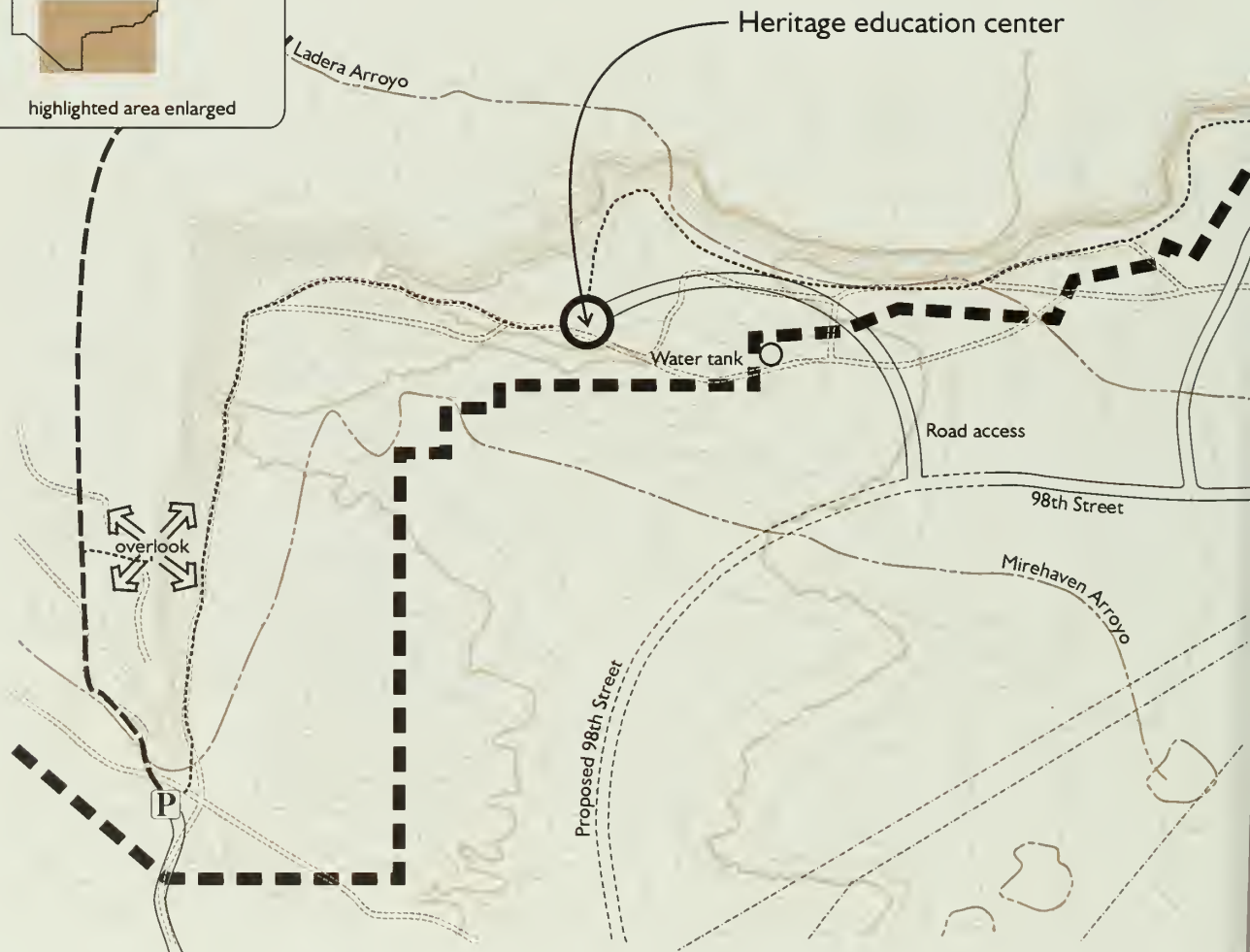
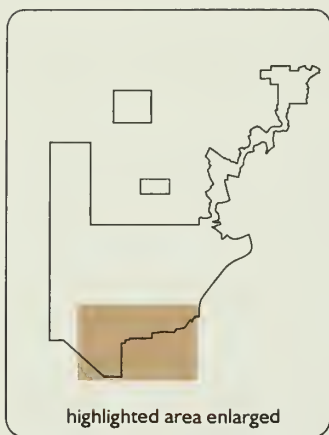


Rinconada Canyon Development Concept Plan

Petroglyph National Monument
U.S. Department of the Interior
National Park Service
August 95 • 354 • 20,018



-  development zone
-  proposed foot trail
-  proposed multiuse trail
-  Petroglyph NM boundary
-  topography
-  existing drainage



Mesa Prieta **Development Concept Plan** **Petroglyph National Monument**

United States Department of the Interior
 National Park Service
 DSC • August 95 • 354 • 20,019

- development zone
- proposed foot trail
- proposed multiuse trail
- Petroglyph NM boundary
- topography
- existing drainage
- existing dirt roads to be revegetated in the monument

nongroup visitors as well as direct organized groups to their program areas. Some exhibit material might be present in the lobby for the public as well as for groups. Use of the Mesa Prieta area by organized groups would be carefully managed through structured educational programs, trail designs, and participation and guidance from rangers.

Outdoor facilities for the center would include a plaza, wayside exhibits, and picnic areas as well as specially designed trails to petroglyph viewing areas, all of which would help in teaching school and other groups about the petroglyphs, their significance and fragility, the 10,000-year occupation of the Rio Grande valley, and other themes as developed. Design of parking and access roads would accommodate buses.

Currently there is no public access to the southern portion of the monument. The Park Service would work with Westland Development Corporation, Inc., to acquire access from the south to the southern portion of the monument where a short access road would connect to a small parking area. From this parking area and trailhead, pedestrian trails would lead along the base of the escarpment to petroglyph viewing areas and to the mesa top, where an overlook of the entire Albuquerque basin, the mountains to the north and east, and the mesa top and volcanoes would be developed.

PETROGLYPH RESEARCH CENTER AND ADMINISTRATIVE FACILITIES — SOUTH OF BOCA NEGRA CANYON

The petroglyph research center would be constructed in the area south of Boca Negra Canyon, either as a separate structure nearby or combined with the new administrative facility (described

below), which would allow easy access by monument staff/interpreters for current information, research, and use of the library. Interpreters would use this information in their daily interpretive programs. (Functions and American Indian and Atrisco land grant heir involvement in the center are described in the "Actions Common to All Alternatives" section.) The existing structures would be removed when no longer needed.

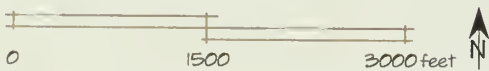
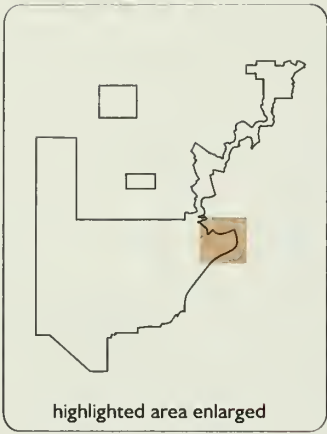
A new administrative facility, including offices and work areas for the administration, law enforcement, interpretation, resource management, and maintenance divisions, would also be constructed in this area south of Boca Negra Canyon.

PARKING AND TRAILHEAD — LAVA SHADOWS

This area would be managed to complement the open undeveloped monument lands at the base of the escarpment and west of Unser Boulevard. The existing structures would be removed when no longer needed, and a small parking area and trailhead would be developed to connect to the multiuse trail on the mesa top (see Lava Shadows Development Concept Plan).

VOLCANOES AREA

Visitor use of the volcanoes would begin at a redesigned parking area (near the existing parking area), where an unstaffed visitor information/bulletin board/shade structure and restrooms would be provided. The parking and visitor information facilities, which would be directly between and somewhat to the west of Vulcan and Black Volcanoes, would be designed to minimize visual intrusions on the cultural landscape.



Lava Shadows **Development Concept Plan**

Petroglyph National Monument

United States Department of the Interior
 National Park Service
 DSC • August 95 • 354 • 20,017

-  development zone
-  proposed foot trail
-  proposed multiuse trail
-  Petroglyph NM boundary
-  topography
-  existing drainage

Existing informal trails and dirt roads, except for those retained for pedestrian or multiuse trails, would be restored to natural conditions to prevent loss of resources due to soil erosion. A picnic area near the parking area but away from the volcanoes would also be provided.

A pedestrian trail south to Black Volcano would lead to the area where an overlook and outdoor exhibits would be developed. (This area, site 2 described below, was surface mined for volcanic rock until the 1980s.) The exhibits would interpret the mesa top and volcanoes. Visitors could appreciate the expansive southwestern landscape with views of the mesa top, Albuquerque basin, and Sandia Mountains, as well as mountains in other directions.

Because the volcanoes are sensitive to the impacts of visitor use (such as trampled vegetation, erosion, and the displacement of rocks and soil) and have religious significance to the Pueblo Indians, only Pueblo Indian religious activities, approved research projects, and occasional guided tours would be permitted at the other volcanoes. Climbing and hiking on any of the volcanoes (except Black Volcano) would also be prohibited to avoid further adverse impacts of visitation.

Vehicular access would be from the Double Eagle II access road (known as the haul road). Use of this existing road for access to the volcanoes would require the modification of an existing agreement between the city and the Federal Aviation Administration. This agreement limits the use of the road for airport access.

There are three abandoned surface mine sites in the area of the volcanoes. Cinder and scoria (vesicular basaltic lava thrown out of the volcanic vents during eruption) were extracted in these areas. The areas are visual intrusions on the landscape in an area that has high potential for visitor

use. A 60-foot highwall (a steep bank excavated into the side of the volcano) at site 1 is a safety hazard for visitors. (See appendix M for more detailed information.)

All three sites would be reclaimed. The combined area of the three sites is about 10 acres. Reclamation would include filling, grading, and revegetation. All three sites would be revegetated with native vegetation. Further archeological investigations, consultation with the American Indian Pueblos, and site documentation would be conducted to ensure that there would be no adverse impacts on sacred sites or other significant resources. If sacred sites would be adversely affected by the above actions, the National Park Service would not conduct the work just described.

GEOLOGIC WINDOWS

Only Pueblo Indian religious activities, approved research projects, and guided tours would be permitted. No facilities would be developed. As surrounding properties develop, it would be necessary to reevaluate visitor use and protection programs.

TRAILS/ESCARPMENT CROSSINGS

Mesa-Top Trails/Access/Overlooks

As shown on Alternative 1 map, 15.6 miles of trails (for horseback riding, bicycling, and pedestrians) and 2.8 miles of pedestrian-only trails would be developed on the mesa top — on existing dirt roads whenever possible. The trail along the escarpment rim would be set back a reasonable distance from the rim to avoid adverse impacts (such as erosion and disturbance of plant and wildlife habitat) and for visitor safety.

A 0.5-mile road that extends the southern end of 81st Street into the monument would be constructed on the mesa top. A parking area would be developed, with a fully accessible panoramic viewing area. Visitors could see the Rio Grande valley, the city against the backdrop of the Sandia Mountains, and the mesa top and volcanoes. Information about the significance of the entire landscape would be provided on wayside exhibits.

Spur trails would be developed to selected rim overlook points (not overlooking residences and neighborhoods).

Multiuse trails (pedestrian, bicycle, and horseback riding) would be developed by the city on city open space mesa-top lands adjacent to the monument boundary (west of 81st Street). Where possible, existing dirt roads would be used for these trails. Unused trails would be revegetated.

Visitors would be required to stay on designated trails on monument and adjacent open space lands. Where possible, spur trails, horse tie-ups, and bicycle racks would be designed so that bicyclists and horseback riders could leave their bicycles and horses and walk on trails to see the petroglyphs and overlooks. Visitors would be surveyed to see how horses, bicycles, and numbers of people affects them or if such use in various areas exceeds socially acceptable limits and appropriate visitor experiences.

Conflicts could occur on trails that combine pedestrian, bicycle, and horse use depending on the design of the trail, the terrain, and levels of use. These conflicts usually result from the relative intensity of use, the terrain, and trail conditions. Visitor use levels would not be expected to result in user conflicts.

Trails Crossing the Escarpment

Multiuse (pedestrian, horseback riding, and bicycle) trail crossings of the escarpment would be developed at Lava Shadows, Boca Negra, Calle Norteña, and, if necessary as a critical link to city trails, near the Paseo del Norte study corridor. These escarpment crossings would connect to city Open Space Division lands on the mesa top west of 81st Street and the city's proposed trails below the escarpment. The escarpment crossing near the Paseo del Norte study corridor would connect to proposed city trails along the Piedras Marcadas arroyo that would pass the Piedras Marcadas Pueblo ruin and continue on to the Bosque and to the proposed multiuse trail on the mesa top that connects the northwest portion of Piedras Marcadas Canyon with Boca Negra Canyon along the western edge of the monument boundary.

Neighborhood Access Trails

Neighborhood pedestrian access trails in Paradise Hills (1), Las Marcadas (1), Shenandoah (1), Homestead Circle (1), Santa Fe Village (2), and south of Rinconada Mesa (1) would be provided to cross the escarpment or follow along the escarpment base. No parking would be provided. As new neighborhoods are developed, monument staff would address and evaluate access needs into the monument. Informal neighborhood access trails (social trails) would be revegetated, and users would be required to use designated access points.

Dogs on leashes would be allowed only in designated areas near existing neighborhoods.

Permits for Trail Use

Because of the sensitive nature of all lands within the monument, bicyclists and horseback riders would be required to obtain permits for use of most monument multi-use trails on the mesa top. Permits would not be required for the trails crossing the escarpment at Boca Negra Canyon, Calle Norteña, Paseo del Norte, Lava Shadows, and in the mesa-top trail connecting Boca Negra and Piedras Marcadas units.

The permit system would allow managers to keep accurate track of the number of people using the trail, help managers to determine at what point trails become too crowded, and provide an opportunity to discuss regulations regarding bicycle and horse use and the protection of the fragile resources, the cultural landscape, and visitor experiences. This information helps the permittee understand why the regulations exist and encourages them to observe the regulations. Natural and cultural resources would be monitored to identify resource impacts, as would impacts on other monument visitors and on traditional activities. Using the information about visitor uses (numbers, locations, and types of use) and natural resource impacts, monument managers would take actions to ensure that natural and cultural resources were protected and a quality visitor experience is maintained.

The process of getting permits would be designed to be convenient for both the frequent local users and one-time visitors.

Studies of the impacts of bicycle and horse use in other national park system areas have shown various results and no adverse impacts when use is properly managed. The National Park Service would monitor use and impacts in the monument to ensure that no damage occurs to monument resources from bicycle and horse use.

CULTURAL AND NATURAL RESOURCE MANAGEMENT

The management of the cultural resources would be the same as described in the "Actions Common to All Alternatives" section. In addition, a permitting system for trail use, described above under "Permits for Trail Use" would be implemented to protect cultural and natural resources and to maintain a quality visitor experience. (Trail user permits would be issued for different areas in the different alternatives.) If adverse resource impacts or degradation of visitor experiences are identified, special permitting and enforcement of regulations pertaining to protecting wildlife species listed on state and federal lists as well as cultural resources would be implemented.

OTHER SITES

Homestead Circle park, a city-owned area within the monument and adjacent to Homestead Circle and Westside Elementary, is proposed for passive development by the city. The development of this site would include paths, shade structures, native plantings, and a wall along Homestead Circle Drive to provide some definition and separation from the road. Additional fill would be needed to cover concrete construction debris.

The only access to the mesa top in this area would be the pedestrian trail on the northern end of the site by way of a ridge that separates the site from the Marie Hughes satellite school.

The disturbed area adjacent to Calle Norteña and Taylor Ranch Road would be regraded to more natural contours and seeded with native plants. Parking would be provided for 5–10 cars in a portion of the disturbed area near Calle Norteña.

BOUNDARY ADDITIONS

As well as the two boundary adjustment areas that would be included under all alternatives, under this alternative a boundary adjustment would be made to include lands south of Boca Negra Canyon and north of Mojave (about 10.5 acres, five lots on Mojave Street east of Unser Boulevard). The addition of these lands to the Boca Negra unit would protect views from the visitor center, provide additional lands for visitor service facilities, and prevent incompatible development that would adversely affect visitor use (see appendix J for more details).

STAFFING

The following are identified staffing needs and assumptions for the various facilities and programs outlined in the proposed action. Daily staffing needs reflect the total number of employees required to work in a facility or program during a given day. To provide breaks, lunchtimes, vacations, sick days, training/administrative duties, and operate some facilities longer than an 8-hour workday, the total daily staffing needs do not necessarily reflect the total number of people who would be on duty within a facility at one time.

An easy rule of thumb, and an assumption used in computing the total staffing needs for this plan, is that it is necessary to hire three employees to cover a facility/program that operates seven days/week, nine hours/day, and needs two employees

in attendance at most times. A total of 126 person hours/week are thus required to operate such a facility/program. Under this scenario, there would be at least 6 hours per week (126 person hours needed versus 120 person hours worked) when only one person is on duty.

Total staffing needs are shown as full-time equivalents (FTEs). Unless otherwise noted, positions are permanent and full time. Table 2 is a summary; details are shown in appendix N.

The Piedras Marcadas and Rinconada visitor contact facilities could operate as either staffed or unstaffed facilities. Thus, while the facilities might be open daily, they might only be staffed a portion of the day and/or week.

The staffing needs assume that all functions would be carried out by NPS or city Open Space Division staff. Individual functions would be evaluated regularly to determine if functions could be better and more cost-effectively done through service contracts than hiring additional staff.

COSTS

Development costs for this alternative would be about \$22.7 million; implementation would be in phases (see the following two tables). The estimated NPS annual operating budget would be \$3.3 million; city operational costs would be about \$1.1 million.

TABLE 2. ALTERNATIVE 1, SUMMARY OF STAFFING NEEDS

FUNCTION	TOTAL FTEs NEEDED
Visitor Services	NPS needs = 17 FTEs; city needs ^a = 10 FTEs
Maintenance Operations	NPS needs = 13 FTEs; city needs = 5 FTEs
Visitor and Resource Protection ^b	NPS needs = 12 FTEs; city needs = 5 FTEs
Resource Management	NPS needs = 4.5 FTEs; city needs = 2 FTEs
Petroglyph Research Center	NPS needs = 5 FTEs
Monument Management/Administration	NPS needs = 6 FTEs; city needs = 3 FTEs

a. City staffing needs would be provided by the city Open Space Division.

b. To provide adequate protection for monument resources, there would be a 24-hour law enforcement patrols throughout the year.

TABLE 3. ALTERNATIVE 1, SUMMARY OF DEVELOPMENT COSTS

Facility/Location	Gross Construction Costs ^a	Construction Planning ^a	Total Project Costs
Visitor Center, Boca Negra	\$7,215,400	\$1,377,000	\$8,592,400
Contact Facility, Piedras Marcadas Canyon	717,900	137,000	854,900 ^b
Interpretive trail and outdoor exhibits at Piedras Marcadas Pueblo Ruin	15,100	1,300	16,400 ^b
Contact Facility, Rinconada Canyon	520,300	99,300	619,600
Heritage Education Center, Mesa Prieta	2,434,700	464,600	\$2,899,300
Trailhead and Overlook, Mesa Prieta	78,100	14,900	93,000
Research Center, Administrative, and Maintenance Facilities, South of Boca Negra Canyon	3,391,900	660,800	4,052,700
Parking and Trailhead, Lava Shadows	235,700	44,300	280,000
Volcanoes Area	499,900	95,400	595,300
81st Street Overlook	1,382,700	263,900	1,646,600
Multipurpose Trails ^c — 18.5 mi. x 8' stabilized gravel (typ.)	1,478,400	280,900	1,759,300 ^d
Pedestrian Trails — 9.6 mi. x 3'	287,700	54,900	342,600
Restoring Existing Roads and Scars (scarify, topsoil, seed, mulch) 50 acres	642,000	122,000	764,000 ^d
Complete fencing and signs of monument boundary	225,000	N/A	225,000 ^d
TOTAL	\$19,124,800	\$3,616,300	\$22,741,100

NOTE: Volcano surface mine reclamation costs are not included at this time. See appendix I for a detailed discussion of the size of the facilities mentioned above.

a. Gross construction costs include construction of new facilities, exhibit and audiovisual production, construction supervision, and contingencies. Advanced and project planning costs include aerial/topographic surveys, comprehensive design, utility negotiation, historic furnishings and structural reports, archeological research, construction drawings and specifications, archeological data recovery, exhibit design, and audiovisual design.

b. Actions fully funded by the city.

c. 15.6 miles are in the monument and 2.9 are outside the monument.

d. Actions partially funded by the city.

TABLE 4. ALTERNATIVE 1, IMPLEMENTATION SCHEDULE AND DEVELOPMENT COSTS

Phase 1	Development Costs
Complete fencing and signs of monument boundary	\$225,000 ^a
Construct visitor center, parking, trails, and associated facilities; rehabilitate Boca Negra unit facilities	8,592,400
Construct visitor contact facility, parking, trailhead, trails, and associated facilities at Rinconada Canyon	619,600
Construct visitor contact facility, parking, trailhead, trails, and associated facilities at Piedras Marcadas Canyon	854,900 ^b
Initiate the development of mesa-top trails	700,700 ^a
TOTAL PHASE 1	\$10,992,600
Phase 2	
Develop volcanoes trailhead, parking, picnic area, overlook, and restrooms	595,300
Construct interpretive trail and outdoor exhibits at Piedras Marcadas Pueblo ruin	16,400 ^b
Construct heritage education center, access road, parking and trails	2,899,300
Construct monument headquarters and petroglyph research center	4,052,700
Complete trail network, Piedras Marcadas and Boca Negra units	700,600 ^a
Site restoration/revegetation of existing roads and scars	764,000 ^a
TOTAL PHASE 2	\$9,028,300
Phase 3	
Construct Mesa Prieta access road, overlook, trailhead, and parking	93,000
Construct 81st Street access road, overlook, trailhead, and parking	1,646,600
Complete trail network for Atrisco unit	700,600 ^a
Construct parking and trailhead at Lava Shadows	280,000
TOTAL PHASE 3	\$2,720,200
TOTAL ALL PHASES	\$22,741,100

a. Actions partially funded by city.

b. Actions fully funded by the city.

ALTERNATIVE 2

INTRODUCTION

The overall approach of this alternative would be to preserve the greatest portion of the monument and adjacent lands in as natural a condition as possible with the fewest intrusions from development and fewer opportunities for public access and use.

Visitors would be directed to a visitor center at Lava Shadows that would have the same programs as in the proposed action. Visitors would have access to selected petroglyph panels in the Lava Shadows area and would walk about a mile or drive to other petroglyph concentrations (see Alternative 2 map). Some visitors would have more opportunities than under the preferred alternative to see petroglyphs with a sense of solitude because of the more difficult access to the Rinconada Canyon. Visitors would have relatively easy access to see petroglyphs in context at Mesa Prieta and at Boca Negra and Piedras Marcadas Canyons. A heritage education center would be built at Boca Negra Canyon.

More areas of the monument would be reserved for research, American Indian traditional use, and occasional guided tours. Horse and bicycle use would not be permitted in this alternative except in two escarpment crossing areas (at Boca Negra Canyon and Calle Norteña). It is recommended that the city Open Space Division manage the mesa-top lands north of the monument the same as monument lands would be managed, for pedestrian use only.

An overlook and picnic area, accessible by vehicles (in the 81st Street boundary addition, described below), and pedestrian

trails would be constructed, as well as multiuse trails outside the monument.

Development concept plans and development zones for Boca Negra Canyon (with a heritage education center instead of the visitor center and without the administrative facility and research center), Piedras Marcadas Canyon, Lava Shadows (with a visitor center instead of the parking area), and Mesa Prieta (without the heritage education center site and with an information kiosk instead of an overlook) shown in alternative 1, also apply to alternative 2.

PARTNERSHIP JURISDICTION, ROLES, AND RESPONSIBILITIES

The roles and responsibilities would be the same as alternative 1 except that the city Open Space Division would be chiefly responsible for visitor services, visitor and resource protection (law enforcement), and maintenance operations in the Boca Negra unit. The city would share staffing responsibility at the visitor center.

VISITOR CENTER — LAVA SHADOWS

Visitors would be directed to the new visitor center and parking area at Lava Shadows — the major visitor use/information/orientation area in the monument under this alternative. Existing structures would be removed when no longer needed. The primary interpretive concepts and the visitor center functions would be the same as described under alternative 1.

From the center, all visitors could walk a short distance to see a few petroglyphs along the base of the escarpment on accessible trails; most visitors could also

continue on a 0.5- to 0.75-mile softer-surfaced pedestrian trail to the top of the escarpment (on an existing abandoned road) to areas with several examples of Rio Grande style petroglyphs. The trailhead at Lava Shadows would provide pedestrian access to the rest of the monument.

VISITOR CONTACT FACILITIES

Piedras Marcadas Canyon

This canyon would be developed much as described under alternative 1 — with a visitor contact facility, access from Paseo del Norte, parking, restrooms, a universally accessible, more intensive use outer canyon pedestrian trail, and a soft-surfaced inner canyon trail. Permits would be required for the inner canyon trail. If visitor use increases beyond the carrying capacity in the inner canyon, the number of permits would be limited.

Under this alternative only one other access to the canyon, from a small parking area (15-20 cars) and access road from Unser, would be established on the mesa top near the northwestern part of the canyon and monument boundary.

Piedras Marcadas Pueblo Ruin

Visitor use at the Piedras Marcadas Pueblo ruin would be the same as alternative 1, with a city-owned and -managed visitor contact facility outside monument lands, access from and parking on the city lands to south of the monument, and an interpretive trail. Interpretation would also be as described in alternative 1, including the use of noninvasive techniques to conduct archeological research and Indian

daily life during the active period of the pueblo. The site would be staffed whenever it was open to visitors to reduce chances of vandalism, destruction, and theft.

HERITAGE EDUCATION CENTER — BOCA NEGRA CANYON

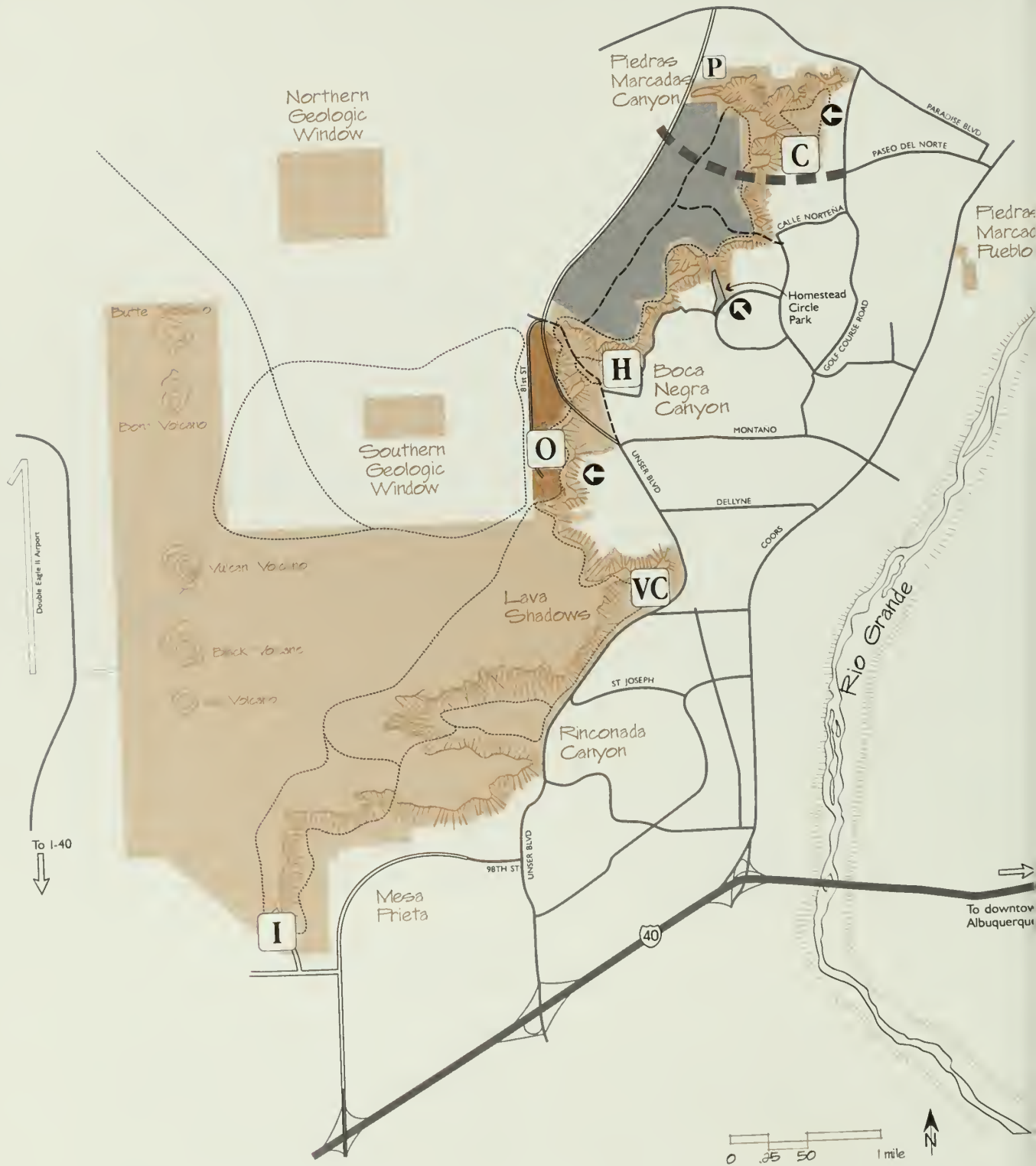
A heritage education center, with functions as described in alternative 1, would be developed at Boca Negra Canyon. The pedestrian trail system at the canyon would be improved, along with the shade structures and parking, to better accommodate the needs of groups, protect the petroglyphs, and allow visitors to see the petroglyphs in adjacent areas, such as along Staghorn Drive.

PETROGLYPH RESEARCH CENTER — OFFSITE LOCATION

The petroglyph research center would be located near the Indian Pueblo Cultural Center or the University of New Mexico. The functions of the center would be as described under alternative 1.

INFORMATION KIOSK — MESA PRIETA

Mesa Prieta would be accessible to visitors via an access road off 98th Street. A small parking area (10-15 cars), restrooms, and orientation area/information kiosk/shade structure would be constructed. A pedestrian trail accessible to all ages and abilities would lead to nearby petroglyphs. Trails that would not be accessible to visitors with disabilities would continue to the mesa top and further into Mesa Prieta below the escarpment.



Alternative 2

Petroglyph National Monument

United States Department of the Interior
National Park Service
DSC • August 95 • 354 • 20,006

Alternative 2



Java Shadows

visitor center

Piedras Marcadas Canyon

visitor contact facility

Piedras Marcadas Pueblo Ruin

visitor contact facility

Mesa Prieta

visitor information kiosk

Poca Negra Canyon

heritage education facility

Rinconada Canyon

foot trail

Petroglyph Research Center

leased space outside monument

Volcanoes

limited use; parking

occasional guided tours

Ecologic Windows

no development; limited use

occasional guided tours

1st Street

improved road

views, picnic area, and parking

Homestead Circle Park

restored to natural conditions

Administration would be in leased space
site.



visitor center



visitor contact facility



visitor information kiosk



administrative facility



heritage education center



petroglyph research center



overlook



parking area



neighborhood access



Petroglyph National Monument



escarpment



foot trail



multiuse trail



boundary addition



nonfederal protected land



Paseo Del Norte study corridor



proposed paved road



PEDESTRIAN TRAIL — RINCONADA CANYON

Rinconada Canyon would be accessed via a 1-mile hard-surfaced pedestrian trail from the Lava Shadows trailhead and from more primitive soft-surfaced pedestrian trails from Mesa Prieta and the mesa top. More frequent visitor contacts would be expected in the outer portion of Rinconada Canyon, and the hard-surfaced trails would minimize erosion and maintenance. The inner canyon trails would be more primitive, softer-surfaced material than the outer canyon trails and would not be accessible to visitors with disabilities; these trails would be managed to give visitors the chance to see the petroglyphs with a sense of solitude.

A permit system would be adopted for the inner canyon. If visitor experiences are adversely affected or resource impacts occur, the number of permits would be limited. No other facilities would be developed.

NONFEDERAL PROTECTED AREA

Under this alternative, it is recommended that a private/public partnership be established to protect an approximately 475-acre area west of the monument, east of the proposed Unser Boulevard, and north of Boca Negra Canyon. The area is not currently served by water, sewer, or electricity; most of the area is zoned for single-family housing and has been subdivided into lots of approximately 10,000 square feet that are owned by various individuals.

Portions of the area would be managed and protected by nonfederal methods for open space and recreational uses, and other portions of the area could take the form of a planned community where single-family housing would be clustered

or combined with multifamily housing and commercial uses and public open space. Nonfederal methods would include acquisition by the city, state, or private trust, land use regulation or planned unit development, conservation easements, or a combination of methods. The public open space dedicated as part of this project would allow horse and bicycle trail connections with other parts of the city.

VOLCANOES AREA

Unlike alternative 1, no access would be allowed to the five volcanoes (including Black Volcano) except for American Indian religious activities, approved research projects, and occasional guided tours. The parking area would be left as is, but the entrance would be gated to restrict access.

Reclaiming abandoned mine sites 1, 2, and 3 would be as described in alternative 1.

GEOLOGIC WINDOWS

As described in alternative 1, only American Indian religious activities, approved research projects, and occasional guided tours would be permitted. There would be no facilities developed.

ROADS, TRAILS, AND ESCARPMENT CROSSINGS

81st Street Addition

With a boundary addition (see description below under "Boundary Additions"), visitors would travel on the existing 81st Street to the monument access road. A trailhead would be established at the end of the road, and a 10-15 car parking area would be constructed for visitors who want to enjoy the expansive views or hike on the mesa top on the pedestrian trail.

Pulloffs along the road would be constructed to allow visitors to see the Rio Grande valley, the city against the backdrop of the Sandia Mountains, and the mesa top and volcanoes. Information would be provided on outdoor panels about the significance of the entire landscape and early and current inhabitants of the Rio Grande valley. Picnic areas would also be provided.

Trails

There would be several pedestrian trails on the mesa top — see Alternative 2 map. These trails, on existing dirt roads, would connect with city trails on the city open space land north of the monument and around the southern geologic window. To provide some relief from the urban environment and encourage visitors to think about the significance of this landscape to ancient and current peoples, no other facilities would be developed. Visitors could explore this environment and experience a sense of the open range, away from the city.

Existing roads not converted to pedestrian trails would be revegetated. A pedestrian trail would be developed on the mesa top along the length of the escarpment from Piedras Marcadas south to Mesa Prieta inside the monument boundary. This trail would follow the western edge of the boundary north of Boca Negra Canyon and would be set back from the escarpment to avoid adverse impacts such as erosion and disturbance to plant and wildlife habitat and for visitor safety.

As in alternative 1, a multiuse trail on the mesa top would be developed from Boca Negra north to Piedras Marcadas Canyon, except in this alternative the trail would be located further west on nonmonument lands on the nonfederal protected area (described above).

There would be pedestrian trails in Mesa Prieta, Rinconada Canyon, and between Lava Shadows and Rinconada Canyon.

The city Open Space Division would manage city-owned lands north of the monument and adjacent to the geologic windows the same as monument lands. To minimize impacts on the cultural landscape, trail use would be restricted to pedestrians. The city would also evaluate options for relocating the equestrian center and the Maloof Model Airplane Field.

Trails Crossing the Escarpment

Multiuse trails (pedestrian, horseback riding, and bicycling) crossing the escarpment would be developed at Boca Negra Canyon and Calle Norteña to connect to the mesa-top multiuse trail that would be constructed in the mesa-top nonfederal protected area north of Boca Negra Canyon (see Alternative 2 map).

Neighborhood Access Trails

Fewer access points for neighborhood residents than described in alternative 1 would be developed (see Alternative 2 map). Residents would be encouraged to walk the extra distances to the fewer access points to minimize impacts on the escarpment. As new neighborhoods are developed, monument staff would address and evaluate access needs into the monument.

Walking dogs on leashes would not be allowed under this alternative except at the two escarpment crossings.

Permits for Trail Use

Because of the sensitive nature of all lands within the monument, visitors would be

required to obtain permits for going into the inner portions of Rinconada and Piedras Marcadas Canyons. Permits would not be required for the trails crossing the escarpment. The permit system would allow managers to track the numbers of visitors using the trails and discuss use regulations and protection of the resources, the cultural landscape, and visitor experiences. The process of obtaining permits would be convenient for both frequent local users and one-time visitors.

Natural and cultural resources would be monitored to identify resource impacts. If resource damage or adverse impacts on visitor use are identified, use would be restricted or eliminated in specific areas.

CULTURAL AND NATURAL RESOURCE MANAGEMENT

The management of monument cultural and natural resources would be the same as described under "Actions Common to All Alternatives." Slightly less monitoring would be needed without the horse and bicycle use trails.

A permitting program for trail users in inner Rinconada and inner Piedras Marcadas Canyons would be implemented in conjunction with the monitoring program.

The Park Service would seek cooperation from the city to manage the adjacent open space lands with the same policies as monument lands to avoid habitat fragmentation that adversely affects plants and wildlife.

OTHER SITES

Homestead Circle park (on monument land) would be restored by the city to as natural a condition as possible. Construction debris would be removed, and

disturbed areas would be revegetated using native indigenous species. A pedestrian trail would be developed near the northern portion of the site, up along the ridge of the escarpment to access the mesa top.

The disturbed area adjacent to Calle Norteña and Taylor Ranch Road would be regraded to a more natural looking contour and seeded with native plants.

BOUNDARY ADDITIONS

In addition to the boundary adjustments that would be made under all alternatives, under this alternative the mesa-top lands between 81st Street and the monument boundary would be added to the monument to provide for the improvement of 81st Street and the new trailhead, parking, view, and picnic area at the south end of 81st Street. This 129-acre area (289 platted lots) in the Volcano Cliffs subdivision (units #2, #5, and a portion of #24) is between the current monument boundary and the city open space lands. Unlike the adjacent open space lands, gravel roads were developed throughout the property as part of the subdivision process in 1967. Ownership is similar to other parts of Volcano Cliffs currently adjacent to and within the monument boundary — mostly individually owned 0.3- to 0.4-acre parcels. When and if utilities are provided to this area, these private lands would be developed as single-family housing.

This mesa-top land is part of the cultural landscape and a visual and physical extension of the monument and open space lands, with the same high-desert vegetation, wildlife habitat, and expansive views of the Rio Grande valley and the Sandias as well as the broad, undeveloped mesa top and volcanoes. The area also provides good opportunities for visitor access to mesa-top and Albuquerque basin

views, parking, and picnic facilities that would not have adverse impacts on monument resources.

The addition of these lands to the monument is feasible in terms of size and configuration. Congressional action would be required for this boundary adjustment. Inclusion of this area within the monument would provide substantial opportunities for visitors to enjoy distant views, both east and west, relatively unimpaired by proposed development. If the property were developed as currently zoned, visitors would not only have viewing opportunities restricted, they would be faced with having visually intrusive development separate existing monument lands from open space lands to the west.

The Volcano Cliffs subdivision was platted in 1967, yet there has been no residential or commercial development on the mesa top to date because of the lack of utilities. With the proposed extension of Unser Boulevard, there is a greater chance that this area will develop. However, a recent fiscal impact analysis by the city indicates that the cost of utility/infrastructure expansion to this area may be substantially more expensive than in other areas of the city. The city's analysis indicates that the average cost of infrastructure (water, wastewater, storm drainage, and transportation) in Volcano Cliffs would be about \$25,000 per lot (because of the

shallow soil and layer of basalt). The development of an average lot in Albuquerque ranges from \$10,000 to \$12,000 (City of Albuquerque, letter dated November 22, 1993). Responsibility for the additional infrastructure costs would be shared by the city and individual lot owners. A substantial amount of the land acquisition costs could be generated by reallocating public funds that would have been used for developing the infrastructure.

STAFFING

Staffing requirements in this alternative would be the same as alternative 1. The interpretive ranger who would be intermittently assigned to the Rinconada visitor contact facility in alternative 1 would have patrol responsibilities in Rinconada Canyon under alternative 2. All new positions would be evaluated to determine the cost-effectiveness of hiring full-time employees or contracting for services.

COSTS

Development costs for implementing this alternative would be approximately \$16.1 million as shown in the following table. The estimated NPS annual operating budget would be \$3.3 million; city operational costs would be about \$900,000.

TABLE 5. ALTERNATIVE 2, SUMMARY OF DEVELOPMENT COSTS

Facility/Location	Gross Construction Costs ^a	Construction Planning ^a	Total Project Costs
Visitor Center, Lava Shadows	\$6,428,000	\$1,226,700	\$7,654,700
Visitor Contact Facility, Piedras Marcadas Canyon	717,900	137,000	854,900 ^b
Interpretive Trail and Outdoor Exhibits	15,100	1,300	16,400 ^b
Information Kiosk, Mesa Prieta	602,600	115,000	717,600
Heritage Education Center, Boca Negra	2,778,700	530,300	3,309,000
Volcanoes	306,300	64,200	370,500
81st Street Overlook and Picnic Area	900,400	171,800	1,072,200
Multiuse Trails (inside monument) 0.9 mi. x 8'	71,900	13,700	85,600 ^c
Pedestrian Trails (inside monument) 18 mi. x 3'	539,500	102,500	642,000 ^c
Multiuse Trails (outside monument) 4.7 mi. x 8 rd	375,700	71,700	447,400 ^b
Pedestrian Trails (outside monument) 8.1 mi. x 3 rd	242,800	46,300	289,100 ^b
Restoration of existing roads (scarify, rip, topsoil, seed mulch) 43 acres	552,000	105,400	657,400 ^c
TOTAL	\$13,530,900	\$2,585,900	\$16,116,800

NOTE: Volcano surface mine reclamation costs are not included at this time. No costs are shown for the administrative facilities because they would be outside the monument in leased space.

a. Gross construction costs include construction of new facilities, exhibit and audiovisual production, construction supervision, and contingencies. Advanced and project planning costs include aerial/topographic surveys, comprehensive design, utility negotiation, historic furnishings and structural reports, archeological research, construction drawings and specifications, archeological data recovery, exhibit design, and audiovisual design.

b. Actions fully funded by the city.

c. Actions partially funded by the city.

d. The Park Service might enter into cooperative agreements with other entities to assist in the planning, construction, and maintenance of these facilities.

ALTERNATIVE 3

INTRODUCTION

The overall approach of this alternative would be to provide easy access to areas with many petroglyphs and to the scenic mesa-top vistas (see Alternative 3 map).

Visitors would be directed to a visitor/heritage education center in Rinconada Canyon where many petroglyphs can be seen without intrusions from adjacent residential development. After orientation at the visitor center, visitors would be directed to petroglyph viewing areas in Rinconada Canyon and to the mesa-top loop road. This road would provide easy access to the mesa-top views and the volcanoes. With the visitor/heritage education center, and hard-surfaced trails at Rinconada Canyon, relatively undisturbed petroglyph concentrations in the canyon would be much more accessible. Parking and trails would be developed at the volcanoes and geologic windows areas. Horse and bicycle use would be provided at two escarpment crossing areas to adjacent city Open Space Division lands.

Interpretive programs would include similar information as in the other alternatives about the petroglyphs, their context, and past cultures, except that there would be increased emphasis on interpreting scenic views and trailside ecology on the mesa top in the visitor center. Mesa-top interpretation would focus (through trail brochures and/or wayside exhibits) on mesa ecology and especially on past use of the mesa.

Development concept plans and the development zones for Boca Negra Canyon (with kiosk but without the visitor center, administrative facility, and research center), Rinconada Canyon (with a visitor center/education center instead of a

contact station), Lava Shadows (with an administrative facility instead of a parking area, and Mesa Prieta, shown in alternative 1, also apply to alternative 3.

PARTNERSHIP JURISDICTION, ROLES, AND RESPONSIBILITIES

Roles and responsibilities would be the same as described under alternative 2.

VISITOR/HERITAGE EDUCATION CENTER — RINCONADA CANYON

Under this alternative the visitor center would be at Rinconada Canyon. This facility would function as described in alternative 1 and include exhibits and a multimedia theater to explain the significance of the petroglyphs, the history of the Rio Grande valley, and the cultures of the people who have lived and passed through the region as well as classrooms that would be used for heritage education programs for organized groups. This education program would function as described in alternative 1.

The canyon would become an intensive visitor use area, with wayside exhibits, guided walks, and patrolling rangers providing interpretation and protection. From the center, visitors could walk to petroglyphs throughout Rinconada Canyon on hard-surfaced trails that would be accessible to people with disabilities. Higher visitation levels would be accommodated in part through several outdoor interpretive exhibits. There would also be a connecting pedestrian trail (not accessible to visitors with disabilities) to Mesa Prieta.

From the visitor center area, visitors would have the option of driving to see other



Alternative 3

Petroglyph National Monument

United States Department of the Interior

National Park Service

DSC • August 95 • 354 • 20,007

Alternative 3



Cinconada Canyon

visitor center/heritage
education facility
improved trails

Piedras Marcadas Pueblo Ruin

visitor contact facility

Desa Prieta

visitor contact/entrance station

Piedras Marcadas Canyon

petroglyph research center

Coca Negra Canyon

visitor information kiosk
improved trails/shade structure/parking

Java Shadows

administration facility

Volcanoes

visitor information
overlook and parking

Geologic Windows

improved trails
parking

Homestead Circle Park

traditional park



- VC** visitor center
- C** visitor contact facility
- I** visitor information kiosk
- A** administrative facility
- H** heritage education center
- R** petroglyph research center
- O** overlook
-  neighborhood access
-  Petroglyph National Monument
-  escarpment
-  foot trail
-  multiuse trail
-  Paseo Del Norte study corridor
-  proposed paved road



petroglyph concentrations at Boca Negra and Piedras Marcadas Canyons or at Mesa Prieta, or driving on the new mesa-top road.

VISITOR CONTACT FACILITIES

Piedras Marcadas Pueblo Ruin

This area would be interpreted and managed as described in alternative 1, with a visitor contact facility and access and parking on city-owned and -managed lands south of the monument outside monument lands and an interpretive trail. The site would be open only when staffed to reduce risk of vandalism, destruction, and theft.

Mesa Prieta

There would be a pedestrian trail, along the base of the escarpment, from the new staffed visitor contact facility/parking area/trailhead at the southern end of the monument. This would be the entrance station to the mesa-top road.

PETROGLYPH RESEARCH CENTER — PIEDRAS MARCADAS CANYON

The petroglyph research center and parking area would be constructed on the mesa top just north of Piedras Marcadas Canyon. Access would be from a new road from Paradise Boulevard. The presence of the center would provide some protection for the petroglyphs and easy access to petroglyphs for researchers. Visitor information and restrooms would be provided in the center.

Two pedestrian trail escarpment crossings would be developed to provide the only access into the canyon; in the canyon there would be pedestrian trails along the base

of the escarpment, along which visitors could see some petroglyphs. Visitor use in the canyon would be controlled by a permit system, which would provide visitors with a sense of solitude and also provide additional protection for the resources.

INFORMATION KIOSK — BOCA NEGRA CANYON

This area would continue to be a primary petroglyph viewing area. Where feasible, existing trails would be improved/redesigned to provide access for visitors with disabilities as well as to provide additional protection for petroglyphs and improve safety for visitors. There would be a small parking area and restrooms, and visitor information would be available at an unstaffed visitor information kiosk.

ADMINISTRATION — LAVA SHADOWS

The current interim visitor center in the Lava Shadows area would be removed and a new administrative structure (as described in alternative 1) would be built.

VOLCANOES AREA

The volcanoes would be managed as described in alternative 1 — with a redesigned parking area (near the existing parking area) and visitor information kiosk, a nearby picnic area, a trail to Black Volcano, the development of an overlook and outdoor exhibits, and the restoration of the previously mined area. However, under this alternative, access would be from the east (the mesa-top loop road) rather than from the airport access road (Paseo del Vulcan). The existing access road would be closed and revegetated. Reclaiming abandoned mine sites 1, 2, and 3 would be as described in alternative 1.

GEOLOGIC WINDOWS

The city Open Space Division would manage the northern and southern geologic windows to promote use and enjoyment. Parking would be provided near the mesa-top rims of these depressions, and pedestrian trails to petroglyph viewing areas would be developed. Parking for both areas would be accessed by existing roads.

ROADS, TRAILS, AND ESCARPMENT CROSSINGS

Mesa-Top Loop Road

Visitors could take advantage of the expansive views from the mesa top by driving on a new, paved, two-way loop road. A new spur road from 98th Street would enter the monument just west of the southern end of Mesa Prieta and travel north onto the mesa top. A staffed visitor contact facility within the monument would provide information about the resources and various points of interest. This contact station would also function as an entrance station for vehicles entering the monument.

Picnic areas and overlooks along the road, including a location on Mesa Prieta and one on the mesa north of Rinconada Canyon, would provide opportunities for visitors to enjoy the expansive views of the city, the Rio Grande valley, and the Sandia and Manzano Mountains. The road would continue north from Mesa Prieta to the northern portion of the Atrisco unit, then head west toward the volcanoes (where a spur road would access the volcanoes parking area, observation area, and accessible trail) and back south to Mesa Prieta.

Multiuse Trails

There would be multiuse trails (pedestrian, bicycling, and horseback riding) on the mesa top, both in the northern part of the monument and in the city open space lands west of 81st Street, and along the escarpment edge from Boca Negra Canyon north to Piedras Marcadas Canyon (see Alternative 3 map).

Trails Across the Escarpment

There would be access across the escarpment via multiuse (pedestrian, bicycle, and horseback riding) trails at Boca Negra Canyon and Calle Norteña, which would connect to existing/proposed city trails, and, if necessary to connect with city trails, a crossing near the Paseo del Norte corridor.

Neighborhood Access Trails

There would be neighborhood access trails at Paradise Hills, Taylor Ranch, and Santa Fe Village. As new neighborhoods are developed, monument staff would address and evaluate access needs into the monument.

Dogs on leashes would be allowed only on designated trails near existing neighborhoods.

Permits for Trail Use

Because of the sensitive nature of all lands within the monument, visitors would be required to obtain permits for going into selected areas. Permits would not be required for the multiuse trails crossing the escarpment. The permit system would allow managers to track the numbers of visitors using the trails and discuss use regulations and protection of the resources,

the cultural landscape, and visitor experiences. The process of obtaining permits would be convenient for both frequent local users and one-time visitors.

Natural and cultural resources would be monitored to identify resource impacts. If resource damage is identified, use would be restricted or eliminated in specific areas.

CULTURAL AND NATURAL RESOURCE MANAGEMENT

Natural and cultural resource management would be the same as described in alternative 1. In addition, a permitting program for trail users in Piedras Marcadas Canyon would be implemented in conjunction with the monitoring program.

OTHER SITES

In this alternative, Homestead Circle park would be developed as a traditional neighborhood park, including a turf grass play area, a children's play structure, picnic tables and benches, and shade trees or shade structure. Access to the mesa top would be the same as in alternatives 1 and 2.

The disturbed area adjacent to Calle Norteña and Taylor Ranch Road would be regraded to a more natural looking contour and seeded with native plants. Parking would be provided for 5–10 cars in a portion of the disturbed area near Calle Norteña.

BOUNDARY ADDITIONS

There would be no additional boundary adjustments under this alternative.

STAFFING

Staffing requirements for this alternative would be the same as alternative 1 except for the following. All new positions would be evaluated to determine the cost-effectiveness of hiring full-time employees or contracting for services.

- The interpretive ranger assigned to the Piedras Marcadas visitor contact facility (alternative 1) would not be necessary.
- The alternative 1 Rinconada Canyon interpretive ranger would be relocated to Boca Negra Canyon.
- To maintain the approximately 10 miles of mesa-top road would require one additional laborer and a heavy equipment operator.
- Two additional permanent protection rangers and one seasonal protection ranger would be needed to patrol the road.
- One additional permanent and one seasonal resource management specialist would be required.

COSTS

Development costs for implementing this alternative would be approximately \$28.8 million as shown in the following table. The estimated NPS annual operating budget would be \$3.4 million; city operational costs would be about \$1.4 million.

TABLE 6. ALTERNATIVE 3, SUMMARY OF DEVELOPMENT COSTS

	Gross Construction Costs ^a	Construction Planning ^a	Total Project Costs
Visitor Center/Heritage Education, Rinconada Canyon	\$7,728,100	\$1,474,800	\$9,202,900
Interpretive Trail and Outdoor Exhibits, Piedras Marcadas Pueblo Ruin	15,100	1,300	16,400 ^b
Visitor Contact Facility, Mesa Prieta	602,600	115,000	716,600
Petroglyph Research Center, Piedras Marcadas Canyon	1,030,400	196,600	1,227,000 ^c
Visitor Kiosk, Boca Negra Canyon	690,400	131,800	822,200
Administration, Lava Shadows	1,720,300	328,300	2,048,600
Volcanoes Area	327,900	62,600	390,500
Mesa-Top Loop Road (10 mi)	9,643,600	1,840,400	11,484,000
Multipurpose Trails (inside monument) 6.7 mi x 8'	535,500	102,200	637,700 ^c
Pedestrian trail (inside monument) 7 mi x 3'	209,800	39,800	249,600 ^c
Multipurpose trails (outside monument) 12.7 mi x 8 ^{td}	1,015,100	193,700	1,208,800 ^b
Restoring Existing Roads (scarify, rip, topsoil, seed, mulch, 50 acres)	642,000	122,500	764,500 ^c
TOTAL	\$24,160,800	\$4,609,000	\$28,769,800

NOTE: Volcano surface mine reclamation costs are not included at this time.

a. Gross construction costs include construction of new facilities, exhibit and audiovisual production, construction supervision, and contingencies. Advanced and project planning costs include aerial/topographic surveys, comprehensive design, utility negotiation, historic furnishings and structural reports, archeological research, construction drawings and specifications, archeological data recovery, exhibit design, and audiovisual design.

b. These costs would be fully funded by the city.

c. These costs would be partially funded by the city.

d. The Park Service might enter into cooperative agreements with other entities to assist in the planning, construction, and maintenance of these facilities.

ALTERNATIVE 4 — NO ACTION

INTRODUCTION

The no-action alternative describes the conditions that would exist at the monument without a change in current management direction or an approved general management plan. This alternative provides a baseline for evaluating the changes and related environmental impacts that would occur under the three action alternatives. Under the no-action alternative, the National Park Service and the city Open Space Division would continue to maintain the monument and the resources and facilities in their existing condition while providing for some increases in visitor use (see Alternative 4 map).

No visitor or heritage education center would be constructed. Monument staff would continue to give guided tours (mostly at Boca Negra Canyon) to school groups. Staff would also bring interpretive programs to school classrooms.

This alternative would have the fewest facilities and the most areas open to multiple uses (horses and bicycles). Neighborhood access points would be similar to the other alternatives. Horseback and bicycle riding would be permitted within the monument only where currently allowed (north of the Atrisco grant line, excluding Rinconada Canyon).

The development concept plan shown in alternative 1 for Rinconada Canyon indicate the general locations for the small parking areas in this alternative.

PARTNERSHIP JURISDICTION, ROLES, AND RESPONSIBILITIES

The city would be chiefly responsible for visitor services, visitor and resource protection (law enforcement), and maintenance in the Piedras Marcadas and Boca Negra units. The existing interim visitor center would be staffed and operated by the National Park Service.

VISITOR CENTER — LAVA SHADOWS

The interim Las Imágenes Visitor Center at Lava Shadows would become the primary visitor center for orientation to the monument. A few exhibits would be provided in the existing space. This facility would only accommodate a limited number of visitors at one time. Visitors would be encouraged to drive to Boca Negra, Piedras Marcadas, and Rinconada Canyons to see the petroglyphs. The existing trail up the cut to the mesa would continue to be used by horseback and bicycle riders and pedestrians).

SOME MODIFICATION — BOCA NEGRA CANYON

Here visitors could see the petroglyphs from established trails, some of which would be made accessible to visitors with disabilities. A slightly expanded parking area and restrooms would continue to be used. As already planned, the city would make minor improvements to trails and expand the shade structure. Heritage education programs would continue at Boca Negra Canyon.

PETROGLYPH RESEARCH CENTER — EXISTING FACILITIES AND STAFF

Petroglyph research center functions would be carried out by existing monument and NPS Southwest Regional Office staff in existing facilities within the allocated budget.

PARKING AND TRAILS — RINCONADA AND PIEDRAS MARCADAS CANYONS

Two small parking areas (10-15 cars) would be established, one at Rinconada Canyon and one near Piedras Marcadas Canyon (accessible from Golf Course Road). Visitors could see the petroglyphs in more primitive conditions in these canyons than they would at Boca Negra Canyon. Although minor improvements would be made to existing trails in these canyons (i.e., the designation of routes), trails would not be accessible to visitors with disabilities. There would be no restrooms at these sites.

PEDESTRIAN TRAIL — MESA PRIETA

No facilities or orientation would be provided at Mesa Prieta. This area would only be accessible on pedestrian trails by visitors willing to travel cross country on the existing trails from the mesa top or follow the trail at the base of the escarpment (accessed from the small parking area at St. Joseph and Unser). Visitor use would be discouraged by not providing information.

LIMITED TOURS — PIEDRAS MARCADAS PUEBLO RUIN

The site would be closed to the public except for specially arranged guided tours. There would be no visitor facilities.

VOLCANOES AREA

Visitor use of the volcanoes would continue, with most use occurring on Vulcan. The parking area that now exists would only be open from dawn to dusk and gated when closed. No onsite interpretation or orientation would occur except for occasional guided tours. The parking area would not be redesigned.

There would be no reclamation of abandoned mine sites 1, 2, and 3.

GEOLOGIC WINDOWS

Visitor use of the geologic windows would be discouraged by not providing information.

ADMINISTRATIVE FACILITIES — SOUTH OF BOCA NEGRA CANYON

Existing structures in this area would be used for administrative functions.

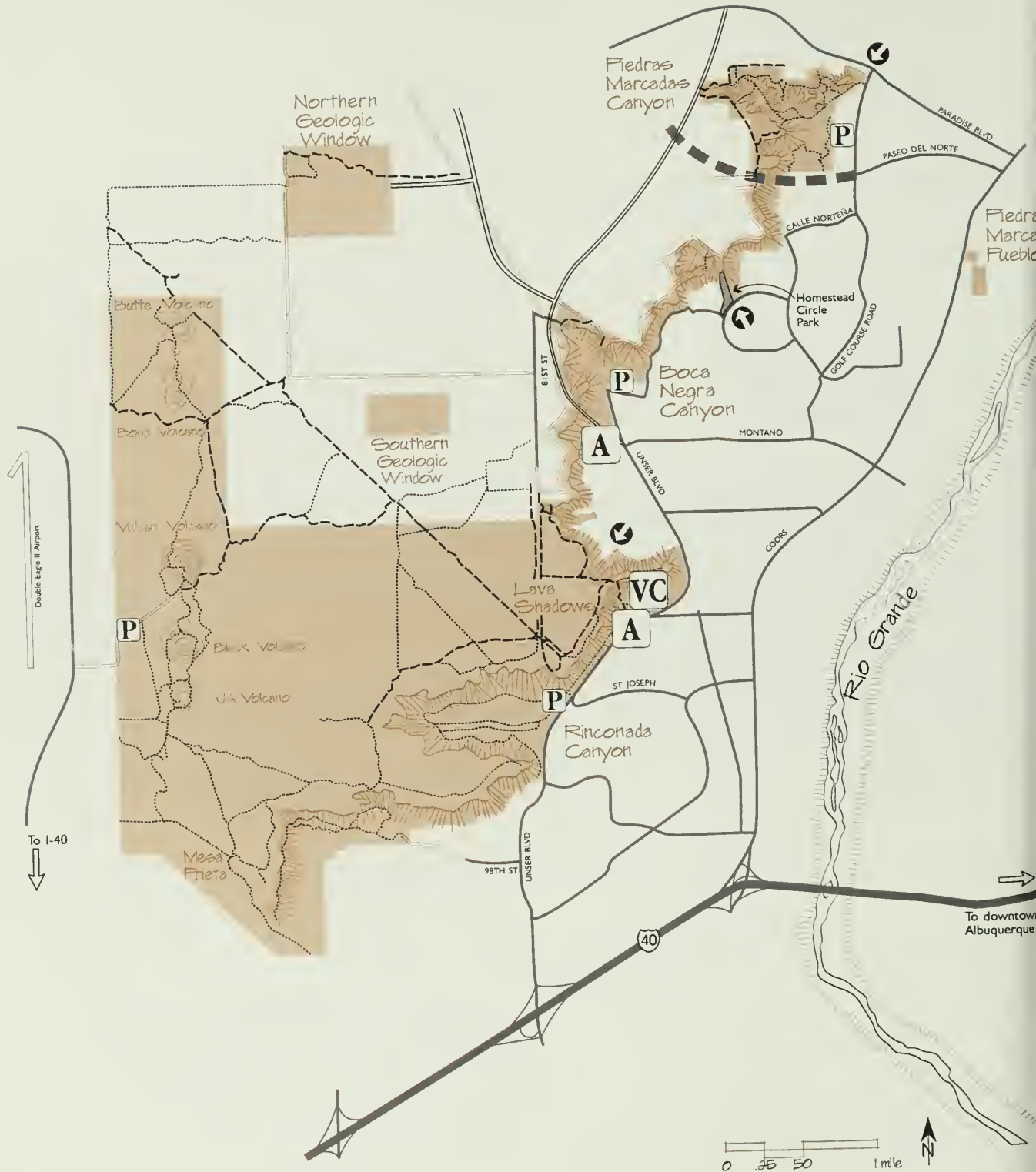
TRAILS AND ESCARPMENT CROSSINGS

Mesa-Top Trails

Visitors could access the mesa from several existing access points. No facilities, new trails, or interpretive exhibits would be provided. Multiuse mesa-top trails would be on existing dirt roads north of the Atrisco grant line.

Escarpment Crossings

Multiuse trail crossings (pedestrian, horseback riding, and bicycling) of the escarpment would be continued at Boca Negra Canyon, Lava Shadows, and Calle Norteña.



Alternative 4



- Lava Shadows
visitor center in existing structure
- Boca Negra Canyon
continuing heritage education functions
improved trails/shade structure
- Chiconada Canyon
parking and trail
- Pedras Marcadas Canyon
parking and trail
- Casa Prieta
foot trail
- Petroglyph Research Center
functions in existing structures
- Pedras Marcadas Pueblo Ruin
limited tours
- Volcanoes
occasional guided tours
existing parking
- Administration
located in existing structures at Lava Shadows
and south of Boca Negra Canyon
- Geologic Windows
development or tours
- Winestead Circle Park
development or revegetation



- VC** visitor center
- C** visitor contact facility
- I** visitor information kiosk
- A** administrative facility
- R** petroglyph research center
- O** overlook
- P** parking area
- neighborhood access
- Petroglyph National Monument
- escarpment
- foot trail
- multiuse trail
- Paseo Del Norte study corridor
- proposed paved road



Neighborhood Access Trails

Pedestrian access trails for adjacent neighborhoods would be established at Santa Fe Village, Homestead Circle, and Paradise Hills. As new neighborhoods are developed, monument staff would address and evaluate access needs into the monument.

Dogs on leashes would be allowed only on designated trails near existing neighborhoods.

Permits for Trail Use

A permit system would not be required or implemented under this alternative.

CULTURAL AND NATURAL RESOURCE MANAGEMENT

Monument staff would continue to inventory and map cultural and natural resources. The Park Service would not have the funds to develop and manage trails in all petroglyph areas and other portions of the monument. Trails would be improved and managed as funds and staffing permit, which would be less than required for proper management but more than permitted by existing staffing and funding levels. The city would continue its current and proposed programs in and adjacent to the monument. Visitors would be encouraged to use existing monument roads and trails and would be prohibited from climbing and scrambling on the escarpment. Monitoring would be done as staff and funds are available; however, there would be less of it than in the other alternatives.

OTHER SITES

Homestead Circle park would not be developed. The city could look for another site outside the monument boundary for a neighborhood park.

No action would be taken at the disturbed area near Calle Norteña and Taylor Ranch Road.

BOUNDARY ADDITIONS

No additional boundary additions would be required for this alternative.

STAFFING

Even though new facilities would not be constructed in this alternative, slightly less staffing (but similar to) than alternative 1, the proposed action, would be required to conduct resource protection and visitor services programs. For comparison purposes and impact assessment, staffing levels presented under this alternative would be less than required for proper resource management and protection. Two fewer interpretive rangers, seven fewer maintenance workers, two less visitor and resource protection staff, and two less resource management staff, and one less administrative staff than under alternative 1 would be required. Because there would be a greatly reduced petroglyph research center function, the staffing of five (in the proposed action) would be reduced to one.

COSTS

Development costs for implementing this alternative would be approximately \$1.4 million as shown in the following table. The estimated NPS annual operating budget would be \$2.9 million; city operational costs would be about \$274,500.

TABLE 7. ALTERNATIVE 4, SUMMARY OF DEVELOPMENT COSTS

Mesa Prieta, Boca Negra, Piedras Marcadas, the volcanoes area, and the Piedras Marcadas Pueblo ruin have no new facilities under this alternative.

	Gross Construction Costs ^a	Construction Planning ^a	Total Project Costs
Visitor Center, Lava Shadows	\$304,400	\$58,100	\$362,500
Minor Modifications, Boca Negra ^b			
Parking and Trails, Rinconada Canyon	163,700	31,300	195,000
Multipurpose Trails (inside monument) 3.3 mi. x 8'	263,800	50,300	314,100 ²
Pedestrian Trails (inside monument) 7.2 mi. x 3'	215,800	41,200	257,000 ²
Restoring (scarify, rip, topsoil, seed, mulch) 18 acres	231,100	44,100	275,200 ²
TOTAL	\$1,178,800	\$225,000	\$1,403,800

a. Gross construction costs include construction of new facilities, exhibit and audiovisual production, construction supervision, and contingencies. Advanced and project planning costs include aerial/topographic surveys, comprehensive design, utility negotiation, historic furnishings and structural reports, archeological research, construction drawings and specifications, archeological data recovery, exhibit design, and audiovisual design.

b. These costs would be partially funded by the city.

TABLE 8. SUMMARY OF ALTERNATIVES

Note: Actions common to all alternatives are not represented in this table.

	Alternative 1 — Proposed Action	Alternative 2	Alternative 3	Alternative 4 — No Action
Overall	Would provide various ways for visitors see and appreciate many monument resources. Easy access to petroglyphs from new visitor center, and easy access to various petroglyph viewing areas. Focus on seeing the petroglyphs in context of the escarpment, mesa top, volcanoes, and surrounding mountains. Pedestrian, horse, and bicycle use permitted on selected designated mesa-top trails.	Would preserve the greatest portion of the monument and adjacent lands in as natural a condition as possible with the fewest intrusions from development and fewer opportunities for public access and use. Visitors could see some petroglyphs near visitor center and walk to other areas where there were more petroglyph concentrations. In Rinconada Canyon visitors could see petroglyphs in more solitude. Relatively easy access to petroglyphs at Boca Negra and Piedras Marcadas Canyons and Mesa Prieta. No horse or bicycle use permitted (except at escarpment crossings). Pedestrian use only in most parts of monument.	Would provide easy access to area with many petroglyphs, especially with the visitor center at Rinconada Canyon, and to mesa-top vistas and the volcanoes via paved loop road.	Would continue existing use while providing for some increase in visitor use (i.e., parking areas and trails). No heritage education center; staff would continue current program and guided tours at Boca Negra Canyon. This alternative would have fewest facilities and most areas open to multiple uses (horses and bicycles). Horseback riding and bicycling would be permitted only where currently allowed. Neighborhood access points similar to other alternatives.
Visitor Center	At Boca Negra with interim heritage education function.	New center at Lava Shadows area.	New visitor/heritage education center at Rinconada Canyon.	Use of existing interim visitor center at Lava Shadows.
Boca Negra Canyon	See above; expand and redesign trail system.	Construct heritage education center; expand and redesign trail system, parking, and shade structure.	Would continue as a primary petroglyph viewing area; restrooms and expanded/redesigned trails; unstaffed visitor information kiosk.	Continue existing use/heritage education program with improvements to parking area and shade structure and minor trail improvements.
Piedras Marcadas Canyon	Small parking area with visitor contact facility and exhibits, restrooms, and trail to inner canyon.	Same as alternative 1 plus small parking area/trail access in northwestern part of canyon.	Petroglyph research center constructed on mesa top north of canyon, accessed from Paradise Boulevard; two pedestrian trails into inner canyon trail (used by permit).	Small parking area on mesa top at northwest part of canyon; soft-surfaced pedestrian trail into canyon.

	Alternative 1 — Proposed Action	Alternative 2	Alternative 3	Alternative 4 — No Action
Rinconada Canyon	Small parking area and visitor contact facility with restrooms; canyon accessible only by pedestrian trails (initial part of trail accessible to those with disabilities).	Outer canyon access only via 1-mile hard-surfaced trail from Lava Shadows and soft-surfaced trails from Mesa Prieta and the mesa top; inner canyon access via soft-surfaced trails; permit system for inner canyon.	Visitor/heritage education center and hard-surfaced trails.	Small parking area with soft-surfaced pedestrian trail into canyon.
Mesa Prieta	For short term, pedestrian trail access only; for long term, if needed, heritage education center near water tank and small parking area, overlook, and trailhead.	New small parking area, restrooms, and visitor information kiosk. Hard-surfaced pedestrian trail to nearby petroglyphs, and soft-surfaced pedestrian trail to mesa top and trail below escarpment.	Pedestrian trail along base of escarpment; staffed visitor contact facility, parking, and trailhead at southern end (entrance to mesa-top loop road).	No new facilities or orientation; accessible by pedestrian trail from mesa top or from parking area in northern part of Rinconada Canyon; visitor use discouraged.
Piedras Marcadas Pueblo Ruin	Interpretive trail. Prepare ruins management plan. City-owned and managed visitor contact facility outside monument lands.	Same as alternative 1.	Same as alternative 1.	Closed to public except for specially arranged guided tours. No visitor facilities.
Area South of Boca Negra Canyon	New administrative facility and petroglyph research center, possibly combined. Existing structures removed.	Remove existing structures and revegetate.	Same as alternative 2.	Some administration in existing structures.
Lava Shadows	Provide parking area and trailhead and connections to other trails. Remove existing structures when no longer needed.	New visitor center. Visitors could go a short distance to see a few petroglyphs along escarpment base on accessible trails. Trailhead would provide pedestrian access to rest of monument. Remove existing structures when no longer needed.	Existing interim visitor center would be removed, and a new administrative structure would be built.	Current interim visitor center would become primary visitor center.
Volcanoes area	Redesigned parking area, unstaffed visitor information kiosk, restrooms, picnic area, trail to Black Volcano overlook and exhibit area; limited use of other volcanoes; no hiking or climbing.	No public access except for Pueblo Indian religious activities, approved research projects, and occasional guided tours; gated entrance	Same as alternative 1, but access would be from east (loop road); revegetate existing road.	Existing use would continue. Parking area open dawn to dusk; no interpretation except for occasional guided tours.
Abandoned surface mines	Mining sites would be reclaimed.	Same as alternative 1.	Same as alternative 1.	No reclamation

TABLE 8. SUMMARY OF ALTERNATIVES (CONT.)

	Alternative 1 — Proposed Action	Alternative 2	Alternative 3	Alternative 4 — No Action
Geologic windows	Only Pueblo Indian activities, approved research projects, and guided tours permitted; no facilities	Same as alternative 1.	Parking areas and pedestrian trails developed for visitor use; access by existing roads.	Use discouraged; no information provided to public
Petroglyph research center	See area south of Boca Negra Canyon	In leased space near Indian Pueblo Cultural Center or University of New Mexico	At Piedras Marcadas Canyon (described above)	Functions carried out by existing monument and NPS regional office staff in existing facilities and within allocated budget
Trails and roads	Pedestrian and multiuse trails on mesa top; overlook and exhibit panels at extension of 81st Street. Escarpment crossings at Lava Shadows, Boca Negra, and Calle Norteña (and maybe near Paseo del Norte corridor). Seven neighborhood access points; revegetating other social trails. Permits required for most monument multiuse trails on mesa top and possibly for Piedras Marcadas and Rinconada Canyons. Impacts on resources monitored and mitigated if necessary.	1.3-mile road extended east from 81st Street, with trailhead, overlook and exhibit panels, small parking area, pulloffs with views, and picnic areas; several pedestrian trails on mesa top, one trail going the length of the escarpment; multiuse trail on nonfederal protected area; pedestrian trails in canyons and at Mesa Prieta; multiuse trails at escarpment crossings at Boca Negra and Calle Norteña; fewer designated neighborhood access points; permits for Rinconada and Piedras Marcadas Canyons.	10-mile paved loop road on mesa top, with picnic areas and overlooks; multiuse trails on mesa top in open space lands and between Boca Negra and Piedras Marcadas Canyons; escarpment crossings at Boca Negra and Calle Norteña, and if necessary at Paseo del Norte; neighborhood access in three areas; permits required for Piedras Marcadas Canyon.	No facilities, new trails, or interpretive exhibits; multiuse trails on existing dirt roads north of Atrisco grant line; pedestrian trails in other parts of monument; escarpment crossings at Boca Negra, Lava Shadows, and Calle Norteña; neighborhood access in three areas. No permit system.
475-acre nonfederal protected area	N/A	Recommended nonfederal protection to encourage use as open space and recreational uses and some form of planned community.	N/A	N/A
Other sites	City development of Homestead Circle park facilities for passive neighborhood use; small parking area at Calle Norteña/Taylor Ranch Road area.	Homestead Circle park restored to natural conditions by city; Calle Norteña/Taylor Ranch Road area revegetated.	Homestead Circle park developed as typical neighborhood park by city; small parking area at Calle Norteña/Taylor Ranch Road area.	No development at Homestead Circle park; no action at Calle Norteña/Taylor Ranch Road area.
Boundary additions not common to all alternatives	Five lots (10.5 acres) on Mojave Street south of Boca Negra Canyon	129 acres of mesa-top lands between 81st Street and the monument boundary.	None	None

	Alternative 1 — Proposed Action	Alternative 2	Alternative 3	Alternative 4 — No Action
Staffing	57.5 additional FTEs, NPS 25 additional FTEs, city	Same as alternative 1; slightly different assignments	Generally the same as alternative 1 with one less interpretive ranger and five additional staff.	Generally the same as alternative 1, but with 13 less staff and one person (instead of five) staffing research center.
Development Costs	\$22.7 million	\$16.1 million	\$28.8 million	\$1.4 million
Operations Costs NPS City	\$3.3 million \$1.1 million	\$3.3 million \$900,000	\$3.4 million \$1.4 million	\$2.9 million \$274,500

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES

TOPIC	ALTERNATIVE 1 — PROPOSED ACTION	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
CULTURAL RESOURCE IMPACTS	No petroglyphs would be moved or directly affected by construction. Developing trails and viewing areas and requiring visitors to stay on trails would have a positive effect on petroglyphs and their context by providing established viewing areas and by removing trails that wind through and between petroglyph concentrations or that are too close to the features and allow visitors to touch or scratch the petroglyphs. Focusing visitor use in areas that previously had no visitor facilities could result in some increased risk of damage to cultural resources. Monitoring resource conditions and responding to potential threats would reduce impacts on petroglyphs and other sites from increased visitation and minimize most of the potential impacts that could occur over time and gradually diminish the integrity and scientific value of these cultural resources. Establishing an increased presence (including frequent patrols), directing and controlling visitor use through such measures as constructing new trails and rehabilitating existing trails, enforcing regulations, and expanding visitor education programs would help protect the cultural resources. During construction, dust, fumes from vehicles, noise, and large equipment would temporarily diminish the visual qualities of the cultural landscape and increase site-specific noise levels. Constructing buildings, trails, utility lines, access roads, support facilities for various areas of development, and reclamation and revegetation work would have the potential to impact known and unknown archeological and ethnographic resources and the cultural landscape. Precautions would be taken to avoid unknown possibly adverse effects of construction-related compaction and vibration on cultural resources. The identification and evaluation of cultural resources, and appropriate siting and design (with compatible materials) of facilities and trails would help reduce the impacts of development, minimize visual impacts on these resources and the landscape, and avoid direct impacts on sites during construction as well as later indirect impacts on significant sites. Early participation by the state historic preservation office and the Advisory Council on Historic Preservation in scoping and design of new facilities would help prevent negative impacts from development. Visitor facilities would intrude on the cultural landscape, but sensitive siting and design would minimize negative impacts. If it were impossible to avoid sites during construction, further mitigative measures would be developed before final design and ground disturbance, in consultation with appropriate agencies and entities. Provisions for protecting previously unknown sites encountered during construction would be included in construction documents, and an archeologist would monitor ground-disturbing activities. There would be a positive effect of trail redesign at Boca Negra Canyon. Some increased risk for damage or vandalism in four main canyons because of increased visitor use would occur. All efforts would be made to prevent vandalism. Research center would promote research and public education and appreciation, which would help prevent adverse impacts. Designating trails for horseback and bicycle riding and requiring riders to obtain permits and stay on established routes would help protect sites from illegal collecting and disturbance. Eliminating use on all but Black Volcano would have a beneficial effect on resources in that area.	Most impacts would be the same as alternative 1. There would be less impact on the cultural landscape and archeological sites in this alternative than in alternative 1 because development is generally focussed in previously disturbed areas. Limiting visitor access to the volcanoes area would have a positive impact on that area's cultural landscape and resources. Overall, impacts on petroglyphs would be similar to alternative 1, but the impacts would be in different areas for each alternative because of the different location of visitor use facilities. Because facilities would not be located in Mesa Prieta or Rinconada Canyon, there would be fewer impacts on the cultural landscape.	Most impacts would be the same as alternative 1. There would be negative effects on cultural resources. The location of major facilities in primary resource areas would provide easy access to important resources; however, negative indirect impacts on petroglyphs could occur. This alternative would directly impact more archeological sites and would require more costly programs to mitigate than any of the other alternatives. The presence of the research center in Piedras Marcadas Canyon would help reduce vandalism and collecting in that area and promote public education. Increased numbers and mobility of visitors on the mesa top and elsewhere would increase risks for relic hunting and vandalism. Multiuse trails in the northern section would increase the possibility of damage to archeological resources. The mesa top road and the visitor center in Rinconada would have more impacts on the cultural landscape than the other alternatives. There would also be a greater risk for long-term loss of cultural resources under this alternative.	Negative impacts on resources, including increased risk to petroglyphs, would result from the lack of adequate funding, staff, and facilities and the limited interpretive and resource protection programs. The limited petroglyph research center function would promote research and education and conservation of the petroglyphs, but these gains would be less effective than in the other alternatives. Fewer direct negative impacts on archeological sites from construction would be anticipated than in the other alternatives. Because of the minimal monitoring and regulation on the many existing horseback riding and bicycle trails, there would be greater potential for damage to archeological resources. This alternative would have the fewest negative effects on the cultural landscape resulting from visitor use developments, but there could be adverse effects from less directed and managed visitor use.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES (CONT.)

TOPIC	ALTERNATIVE 1 — PROPOSED ACTION	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Cumulative Impacts on Cultural Resources	Over time, vandalism, illegal collecting, and inadvertent damage to petroglyphs and other archeological sites reduce the number and quality of sites, which would result in a cumulative impact on the sites and database. Various efforts and programs would minimize but not eliminate these impacts. With development, visitor use and maintenance activities, erosion, etc., some diagnostic artifacts and features would not be preserved for future analytic techniques. Monument development combined with adjacent development would adversely affect the cultural landscape. There would be cumulative impacts from NPS actions combined with the city's extension of Unser Boulevard and there might be impacts from the city's development of the recreational trail and utility corridor. Impacts would be mitigated by minimizing rights-of-way and disturbed areas and using appropriate construction techniques and design materials.	Impacts would be similar to those described for alternative 1.	The extent and type of visitor use and facilities provided for in this alternative would be similar to alternative 1 but would result in more adverse cumulative impacts under this alternative than under any other alternative. The cumulative impacts of the city's Unser Boulevard extension and the recreational trail and utility corridor in Boca Negra Canyon would be the same as described for alternative 1.	Over time, lack of staff and adequate funding and facilities to guide visitor use would contribute to loss of resources from vandalism, unauthorized collection, erosion of informal trails, theft of artifacts, and destruction of context by unmanaged horse and bicycle use. The cultural landscape and its values might also deteriorate because use would be less directed or managed than in the other alternatives. These lost resource values would be gradual but incremental and cumulative when combined with resource loss on other federal, state, and private lands. The cumulative impacts of the city's Unser Boulevard extension and the recreational trail and utility corridor would be the same as described for alternative 1.
IMPACTS ON VALUES HELD BY CULTURALLY AFFILIATED GROUPS	Consultation with the American Indian Pueblo community and the heirs of the Atrisco land grant would help ensure that the location and construction of new facilities and the reclamation and revegetation of informal trails or previous development would (1) avoid areas of significance to these groups, (2) be compatible with the cultural landscape and traditional practices, and (3) not affect the viability of resources traditionally gathered by these groups. Some positive impacts would result. Impacts from increased visitation on religious activities are unknown, but special provisions such as temporary closures would provide privacy to conduct traditional activities. Consultation with culturally affiliated groups and training monument staff would ensure that interpretive media and programs present a culturally sensitive and accurate picture of traditional values, which would help reduce negative impacts on cultures affiliated with the monument. There might be positive impacts on these groups by limiting public access to the volcanoes area. Developing Piedras Marcadas Pueblo ruin only after special study and consultation with concerned Pueblos would avoid impacts related to intrusion on sacred and significant areas and human remains and artifacts. There could be adverse impacts from the intrusion of bicycles and horses into lands that are important to the Pueblo community. Cumulative Impacts: There would be a cumulative impact if special ritual sites or features were destroyed or desecrated by vandals, or if practitioners were disturbed by construction or visitors. The city's construction of Unser Boulevard through the monument would adversely impact these groups and their ability to maintain their connections to the monument.	Same as alternative 1. Developing Piedras Marcadas Pueblo ruin only after special study and consultation with concerned Pueblos would avoid impacts related to intrusion on sacred and significant areas and human remains and artifacts. There might be positive impacts on these groups by limiting public access to the volcanoes area. Cumulative Impacts: The cumulative impacts on values held by these groups under this alternative would be similar but less than described for alternative 1. Because fewer visitors would have access to the volcanoes area and there would be no bicycle or horse use in the monument, there would be fewer long-term impacts on resources that are sensitive to culturally affiliated groups. Privacy for religious activities might be easier to achieve, contributing to the continuation of traditional activities in the future.	Same as alternative 1. There would be negative impacts because of the development proposed in this alternative, especially on the mesa top. Developing Piedras Marcadas Pueblo ruin only after special study and consultation with concerned Pueblos would avoid impacts related to intrusion on sacred and significant areas and human remains and artifacts. Cumulative Impacts: The development of mesa-top roads and trails and intensified public use of this area would limit the areas that might be suitable for Pueblo groups to practice their religious activities. The city's construction of Unser Boulevard through the monument would adversely impact these groups and their ability to maintain their connections to the monument.	There might be positive impacts on values held by these groups by participating in consultation regarding site protection and interpretation. Values held by these groups might be negatively impacted by uncontrolled visitor use and more potential for vandalism. There would be less opportunity for visitor education and therefore increased risk of negative impacts on the spiritual values held by these groups. Cumulative Impacts: If petroglyphs or archeological sites, features, and objects are destroyed or desecrated by vandals, or practitioners are not able to use a special area for traditional religious activities, that ritual might not be continued. The city's construction of Unser Boulevard through the monument would adversely impact these groups and their ability to maintain their connection to the monument. Impacts from facility development would be less severe than in alternative 1, however impacts from unrestricted horse and bicycle use would continue.
IMPACTS ON FEDERAL AND STATE THREATENED AND ENDANGERED SPECIES	Eagles and whooping cranes (federally listed species) migrating through the monument would not be affected. The black-footed ferret, also listed, would not be adversely impacted. The millipede (<i>Toltecolus chihuensis</i>), a category 2 species, would not be adversely affected by NPS actions. Cumulative Impacts: Cumulative impacts on the <i>Toltecolus chihuensis</i> millipede might result when city actions for constructing Unser Boulevard are considered in combination with NPS actions. Site-specific surveys before construction would mitigate such impacts.	Same as alternative 1.	Same as alternative 1.	Same as alternative 1.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES (CONT.)

TOPIC	ALTERNATIVE 1 — PROPOSED ACTION	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Plants	About 15 acres of potential rare cactus habitat, (30% of the total available habitat) would be adversely impacted by development and visitor use. This would not be significant in terms of the habitat available in the monument. Cumulative Impact: Development actions under this alternative could incrementally contribute to the overall decline of the two rare cactus species. Cumulative impacts would not be anticipated because of the city's construction of Unser Boulevard and the recreational trail and utility corridor.	About 7.5 acres of potential rare cactus habitat would be adversely impacted by development and visitor use. This would not be a significant impact. There would be fewer people on the mesa top than in the other alternatives and thus less disturbance to this habitat. Cumulative Impacts: Development actions could incrementally increase the amount and severity of potential impacts on these cacti and could contribute to the decline of these species. Cumulative impacts would not be anticipated because of the city's construction of Unser Boulevard and the recreational trail and utility corridor.	About 50 acres of potential rare cactus habitat could be adversely impacted by development, and visitor use; this would be a significant adverse impact. Cumulative Impacts: The destruction of potential habitat for these cacti could contribute to the overall decline of the species. Cumulative impacts would not be anticipated because of the city's construction of Unser Boulevard and the recreation trail and utility corridor.	About 8.5 acres of potential rare cactus habitat would be adversely impacted by development and visitor use. This would not be significant. Cumulative Impacts: Development actions under this alternative could contribute to the extinction of the two cactus species. Cumulative impacts would not be anticipated because of the city's construction of Unser Boulevard and the recreation trail and utility corridor.
Birds	Without mitigation, the ferruginous hawk would be significantly adversely affected by development and use. Mitigation measures would avoid significant adverse effects on the ferruginous hawk. Cumulative Impacts: Without mitigation, facility development along with development of lands outside the monument and the city's construction of Unser Boulevard could incrementally increase the amount and severity of the impacts on the ferruginous hawk and could contribute to its elimination as a breeding species in this area. With mitigation, there would be no significant adverse cumulative impacts on the ferruginous hawk.	Managing monument lands for pedestrian use only along with the 2,200 acres of open space lands north of the monument might have less adverse impacts on the ferruginous hawk than in alternative 1. Development of previously closed areas would likely adversely affect the hawk. Cumulative Impacts: Developing certain sites, combined with adjacent residential development and the city's construction Unser Boulevard, might disturb the ferruginous hawk and could contribute to the species' overall decline. With mitigation, there would be no significant adverse cumulative impacts on the ferruginous hawk.	Development would have a significant adverse affect on the ferruginous hawk. It would be eliminated from the area as a breeding species. Cumulative Impacts: Developing certain sites, combined with adjacent residential development and the city's construction Unser Boulevard would eliminate the hawk from the area and would contribute to the overall decline of the ferruginous hawk nationwide. With mitigation, there would be no significant adverse cumulative impacts on the ferruginous hawk.	Development would not adversely affect the ferruginous hawk. Development actions would not contribute to the nationwide decline of this species. Cumulative Impacts: Overall, cumulative impacts would be similar to alternative 1, but they would be slightly less due to the limited facility development in this alternative. With mitigation, there would be no significant adverse cumulative impacts on the ferruginous hawk.
IMPACTS ON WILDLIFE OTHER THAN LISTED SPECIES	Birds and Other Wildlife No significant impacts on birds and other wildlife would be anticipated from developing facilities and trails on 55 acres in the monument. Some wildlife populations would be adversely affected due to trails, people, horses, and bicycles on the mesa top. Cumulative Impact: About 55 acres of monument facility and trail development combined with the city's construction of Unser Boulevard and adjacent development would cumulatively impact birds and other wildlife species by destroying habitat and creating a barrier to movement by some wildlife.	Birds and Other Wildlife No significant impacts on birds and other wildlife would be anticipated from developing facilities and trails on 23 acres. Protecting 129 acres of wildlife habitat would be a beneficial impact for all species, as would the revegetation of 50 acres of disturbed lands. Cumulative Impacts: Impacts would be similar to those described in alternative 1 plus the additional protection of 475 acres adjacent to the monument and the 129 acres in the boundary adjustment would help avoid significant adverse cumulative impacts on birds and other wildlife.	Birds and Other Wildlife About 78 acres of wildlife habitat would be impacted under this alternative. Adverse impacts on birds and other wildlife would be significant under this alternative. Cumulative Impacts: Monument development combined with adjacent development and the city's construction of Unser Boulevard would cumulatively impact birds and other wildlife species by destroying habitat. The cumulative impacts would be greatest under this alternative.	Birds and Other Wildlife No direct significant adverse impacts on birds and other wildlife would occur as a result of implementing the no-action alternative. Cumulative Impacts: Over time, increased visitor use of the monument without the use of permits and resource monitoring would adversely impact birds and other wildlife species. Other cumulative impacts would be similar to alternative 1 but slightly less due to limited facility development in this alternative.
IMPACTS ON NATURAL DRAINAGE PATTERNS AND FEATURES	Surface runoff would increase from construction on 55 acres for parking, facilities, and trails. Restoring 30–35 acres of roads and trails on the mesa top and 15 acres of disturbed flat lands would help eliminate existing gullies and prevent further gullying and erosion. Cumulative Impacts: NPS actions considered in combination with development on adjacent lands and the city's construction of Unser Boulevard would impact natural drainage patterns and features. There would be adverse impacts within the new Unser alignment and positive impacts from extending the Unser alignment and providing management of stormwater flows so that monument resources would not be adversely affected.	Stormwater flows in the monument would increase from hardening and compacting 13 acres for parking areas, facilities, and trails. Restoring and revegetating 40 acres of roads and trails on the mesa top would help prevent further gullying and erosion of soils, eliminate existing gullies, and help prevent new gullies from forming. Cumulative Impacts: Cumulative impacts would be similar to alternative 1 but slightly fewer/less because there would be fewer facilities developed in this alternative.	Stormwater flows in the monument would increase from constructing 78 acres of parking areas, roads, trails, and facilities. Restoring about 50 acres of disturbed land and establishing designated trails to gain access to the mesa would decrease gullying activity and erosion. The increased development and stormwater flow from the monument means that storms would have more serious impacts on the monument's natural drainage patterns and features than under the other alternatives. Cumulative Impacts: Cumulative impacts of the city's extension of Unser would be similar to alternative 1 but greater because of the extent of monument road construction in this alternative.	Current erosion and gullying activity would continue on the mesa top and along the escarpment. Stormwater drainage from the monument would increase but not significantly. Cumulative Impacts: Cumulative impacts would be the same as alternative 1, but slightly less due to limited facility development in this alternative.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES (CONT.)

TOPIC	ALTERNATIVE 1 -- PROPOSED ACTION	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
IMPACTS ON BIODIVERSITY	Developing about 55 acres would not result in a significant impact. Restoring and revegetating disturbed areas would replace lost habitat. Cumulative Impacts: Development might adversely affect wildlife populations and biodiversity, although there would be some cumulative benefits from restoring habitat. With the high rate of development occurring adjacent to the monument, less habitat would remain for these populations. The construction of Unser by the city might adversely impact biodiversity by eliminating habitat, increasing noise levels, and preventing some wildlife movement. The monument is likely to become an isolated island of habitat that over time would have a significant adverse impact on biodiversity.	Development of about 23 acres would not likely be a significant adverse impact on biodiversity; restoring about 50 acres of disturbed land would contribute to increased biodiversity. This represents less development and impact than under the proposed action. Cumulative Impacts: Cumulative impacts would be expected to be less than under the proposed action. Nonfederal protection of 475 acres and addition of 129 acres to the monument boundary would have a beneficial cumulative impact on biodiversity in the monument area. The impacts of constructing Unser would be the same as described in alternative 1. The monument is likely to become an isolated island of habitat that over time would have a significant adverse impact on biodiversity.	Developing about 78 acres in the monument would be a significant adverse impact on biodiversity. This would be mitigated by the restoration of about 50 acres of disturbed land. Cumulative Impacts: The combination of species displacement that would occur because of monument development and adjacent land development would result in a cumulative adverse impact on biodiversity. However, there would be some cumulative benefits of restoring habitat. The impacts of constructing Unser would be the same as described in alternative 1. The monument is likely to become an isolated island of habitat that over time would have a significant adverse impact on biodiversity.	No significant adverse impacts on biodiversity would be expected as a result of implementing the no-action alternative. This alternative would have the least beneficial effects on biodiversity. Cumulative Impacts: Due to the high rate of development occurring adjacent to the monument and the city's construction of Unser Boulevard, less habitat would remain for wildlife species, thus displacing them onto monument lands and associated open space lands. The monument is likely to become an isolated island of habitat that over time would have a significant adverse impact on biodiversity.
IMPACTS ON SOILS	Development on about 55 acres would adversely impact soils (and thus plant and wildlife) and the mesa ecosystem. Restoring about 50 acres of other disturbed lands would offset this impact. Impacts would not be significant. Cumulative Impacts: Facility development combined with adjacent development including the city's construction of Unser Boulevard would cumulatively adversely impact soils.	Development on 23 acres of soils would adversely impact soils and the mesa ecosystem. Less impact on soils would occur under this alternative than under alternative 1, and the impacts would not be significant. Restoring about 50 acres of other disturbed lands would have beneficial impacts. Cumulative Impacts: The cumulative impacts would be the same as alternative 1 but fewer/less because less monument development is proposed in this alternative. The nonfederal protected area land and the 129 acres added through the boundary adjustment would be a positive impact.	Development on about 78 acres of soils would result in an adverse impact on soils and the mesa ecosystem. Restoring about 50 acres of disturbed land would be a beneficial impact by stabilizing soils that were subject to erosion. Cumulative Impacts: These impacts would be the same as alternative 1 but more so because there would be more monument development in this alternative.	Visitor use and development on about 22 acres of soils within the monument would not result in an adverse impact on soils and the mesa ecosystem. Impacts from off-trail use could result in a significant impact. This alternative would have the least beneficial impacts on soils because only a small portion of disturbed and compacted soils would be reclaimed. Cumulative Impacts: Cumulative impacts would be similar to alternative 1 but slightly less with the limited facility development proposed in this alternative.
IMPACTS ON SCENIC RESOURCES	This alternative would preserve much of the monument in its natural state. New facilities would have adverse impacts on the natural and cultural environment at selected areas. Cumulative Impacts: Preserving large areas in the monument in its existing state and combining monument revegetation programs with local efforts to preserve the existing scenic resources would produce beneficial visual impacts. The visitor facilities would contribute a minor increase to the overall adverse visual impact of suburban development of the area. Development adjacent to the monument and the city's construction of Unser Boulevard through the monument would adversely affect scenic quality and views from the monument.	The proposals of this alternative would not result in significant adverse impacts on the visual quality of the monument. Adjacent development would adversely impact the views from the monument. Cumulative Impacts: The cumulative beneficial impacts of preservation and restoration would be the same as in alternative 1. Plus, compatible development of the adjacent 475 acres, preservation of open space, and the 129 acres from the boundary addition would have positive impacts on the monument's scenic qualities. The cumulative adverse impacts for this alternative would be less than in alternative 1 due to fewer facilities proposed for the monument.	The visual quality of the monument would be permanently changed and adversely impacted by development. Cumulative Impacts: Development under this alternative would contribute to the increasing suburban development of the west mesa area and prevent the preservation of expansive or important natural views. Proposed actions in this alternative combined with adjacent development and the city's construction of Unser Boulevard would have the similar cumulative impacts on scenic resources as alternative 1, but they would be greater because of the extent of the monument road.	No significant adverse impacts would result from the proposals of this alternative. Adjacent development would adversely affect the scenic quality of views from the monument. Cumulative Impacts: Significant portions of the monument would be preserved in its natural scenic quality, contributing to local efforts to preserve the natural areas of the west mesa. This would result in beneficial, long-term visual improvements for the community. Adjacent development and the city's construction of Unser Boulevard would adversely affect scenic resources and views, but less so because fewer monument facilities would be developed.
IMPACTS ON THE LOCAL AND REGIONAL ECONOMY	Monument establishment and development would continue to provide positive economic benefits for the Albuquerque area. Although the direct economic benefits might be relatively small in relation to the entire economy of the region, they are significant. Even more significant might be the unquantifiable positive benefits that accrue to the region due to the monument's existence and development and the quality of life values it provides and protects. Cumulative Impacts: Positive economic benefits would accrue to the local economy. The city's construction of Unser Boulevard and the recreational trail and utility corridor would benefit the local economy; however, design and construction costs would increase because of needs to minimize impacts on monument resources.	The analysis provided for alternative 1 also applies to alternative 2. It is likely that this alternative would result in less economic benefits than alternative 1. Differences in positive economic impacts between alternatives would be expected, but these cannot be quantified. There would be a net savings to city taxpayers if the 81st Street area were added to the boundary and acquired by the city and the Park Service. Cumulative Impacts: Cumulative impacts would be the same as for the proposed action. The 129-acre boundary addition and the nonfederal protected area would also have long-term positive impacts on the local and regional economy.	The analysis provided for alternative 1 also applies for alternative 3. The monument would be developed, but in a somewhat different manner. Differences in positive economic impacts between alternatives would be expected, but these cannot be quantified. Cumulative Impacts: Same as alternative 1.	The direct economic benefits would remain relatively small in relation to the entire economy of the region. Cumulative Impacts: Although the monument is an addition to the many attractions found in the Albuquerque area, it would not become as important a visitor attraction. Therefore it would be less likely to provide an increase in the economic base for the local and regional economy. The impacts of the city's construction of Unser Boulevard would be the same as alternative 1.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES (CONT.)

TOPIC	ALTERNATIVE 1 — PROPOSED ACTION	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
IMPACTS ON NATIONAL VISITORS	Visitor experience would be improved by preserving the escarpment in its natural state and restricting development within the monument. Cumulative Impacts: Over time a more positive experience for visitors, schoolchildren, and other organized groups would be provided as a result of this alternative. Resources would be better protected, and visitors could gain a greater understanding and appreciation for the purposes for which the monument was set aside. The city's construction of Unser Boulevard and recreational trail in Boca Negra Canyon would benefit visitors by facilitating vehicular, bicycle, horse, and pedestrian access to the mesa and by eliminating vehicular traffic in Boca Negra Canyon. There would be adverse impacts on national visitors because of the visual intrusion, increased noise levels, and the barrier of a four-lane highway. Creative design and material use would minimize these impacts.	This alternative would provide a different experience of the monument than under the other alternatives. There would likely be fewer total visitors to the entire monument because of the more difficult access. Lava Shadows and Boca Negra Canyon would be more crowded and congested than in the proposed action, making it more difficult to convey the significance of monument resources. Cumulative Impacts: The 475-acre nontederal protected area and the 129-acre boundary addition would benefit national as well as local visitors by creating a compatible open space area adjacent to the monument. This compatible management area would help visitors appreciate the cultural landscape of the monument. Impacts of the city's construction of Unser Boulevard and the recreational trail would be the same as alternative 1.	It is likely that the relatively high level of development and resulting visitor use would be inconsistent with Pueblo Indian and Atrisco land grant heirs views of the monument. Thus it would be expected that there would be no support or participation from these groups in managing and interpreting the monument. Opportunities to interpret these cultures' views would be lost, and that would be an adverse affect on visitors. Cumulative Impacts: More visitors would have easy access to primary monument resources such as Rinconada Canyon and the mesa top. The only place for visitors who have come to the monument in the past for a sense of solitude would be Piedras Marcadas Canyon or to more remote federal lands in other portions of the state. Impacts of the city's construction of Unser Boulevard and the recreational trail would be the same as alternative 1.	Implementing this alternative would provide visitors with a less-than-adequate experience and result in an adverse affect. Cumulative Impacts: The impacts of the city's construction of Unser Boulevard and the recreational trail would be the same as described in alternative 1.
IMPACTS ON LOCAL VISITORS AND ADJACENT LANDOWNERS	There would be generally beneficial effects on the local visitors and adjacent landowners because of greater protection of monument resources and accommodation of uses that the Albuquerque public desires. There would be impacts on adjacent landowners because of federal laws requiring no degradation of monument resources and because of the additional time for consultation, design, construction standards, and compliance with regulations. Cumulative Impacts: The city's construction of Unser Boulevard and the recreational trail and utility corridor would benefit local visitors and adjacent landowners by facilitating access and allowing enjoyment of monument resources. There would be adverse impacts from visual and noise intrusions from traffic on Unser. Creative design and material use would minimize these impacts.	This alternative would generally have a beneficial effect on the local visitor and adjacent landowners. Although more limited access is provided to the monument than under alternative 1, local visitors would be provided an experience similar to what exists today in most of the monument. Some residents would be adversely impacted by the restriction of bicycles and horses and closing the volcanoes area. Cumulative Impacts: The cumulative impacts would be the same as described in alternative 1 but slightly less because less development is proposed in this alternative.	This alternative would have a beneficial effect on the local visitor by providing greater separation of national and local visitor traffic and providing areas that would be more likely visited by local visitors. Higher visitation levels could increase the values of nearby commercial properties. Other impacts would be the same as alternative 1. The primary visitor use areas at Rinconada Canyon and the mesa top would reduce the number of vehicles north of Rinconada Canyon on Unser Boulevard and have a beneficial impact on local residents and adjacent landowners. Cumulative Impacts: The cumulative impacts would be the similar to those described in alternative 1 but greater because of the extent of monument facilities.	This alternative would create a monument area primarily for local users and thus would have a beneficial impact on those users. Heritage education would continue to be a small component of the entire education program for the monument. Cumulative Impacts: The cumulative impacts would be the same as described in alternative 1.
IMPACTS ON ENERGY CONSUMPTION	Incorporating and promoting energy conservation in the planning and design of the monument facilities would mitigate most of the adverse impacts of increased energy consumption. Cumulative Impacts: Monument facilities would contribute to increasing demand for energy in the area. Energy conservation measures would mitigate much of the adverse energy consumption impacts.	Same as alternative 1.	The new roads and facilities would result in adverse impacts on energy consumption. Cumulative Impacts: Impacts would be the same as alternative 1. The vehicular use and construction of the mesa-top road would contribute to increasing demands for energy in the area as surrounding suburban development continues to grow. Energy conservation measures would mitigate much of the adverse energy consumption impacts.	No adverse energy consumption impacts would result from implementing this alternative.
IMPACTS OF MONUMENT USE AND ACTIVITIES ON EXISTING NOISE LEVELS	Noise from monument development and operations would not have a significant impact. Cumulative Impacts: Noise from proposed adjacent development near Mesa Prieta, Boca Negra and Piedras Marcadas Canyons, the Piedras Marcadas Pueblo ruin, and the volcanoes would also adversely affect the monument. Combined noise levels from the construction and use of Unser Boulevard, expansion of the Double Eagle II Airport, the proposed Paseo del Volcan, and proposed adjacent development, could cumulatively and significantly increase noise levels in the monument. Mitigation measures regarding the airport, Unser, and Paseo del Volcan would be developed with the Federal Aviation Administration, the state, and the city.	Impacts would be similar to alternative 1. Some areas would have more noise than alternative 1 and some would have less. Cumulative Impacts: Same as alternative 1.	Developing and operating monument facilities would have a significant adverse impact on noise levels. Cumulative Impacts: Same as alternative 1.	Noise from monument development and operations would not have a significant impact. Cumulative Impacts: Same as alternative 1.

TABLE 9. SUMMARY OF THE IMPACTS OF THE ALTERNATIVES (CONT.)

TOPIC	ALTERNATIVE 1 — PROPOSED ACTION	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
IMPACTS ON AIR QUALITY	Overall, the effects on air quality would be minor. No state or federal air quality standards would be exceeded. The emissions generated within the monument would not exceed de minimus levels. Temporary adverse impacts might occur during construction from dust, but they would not be significant. Cumulative Impacts: Particulate matter from constructing proposed monument facilities combined with adjacent construction, including Unser Boulevard, Double Eagle II Airport, and Paseo del Volcan, would have temporary adverse impacts on air quality. The use of the airport and adjacent roads and development would increase emissions.	Same as alternative 1	Same as alternative 1.	No adverse impact on air quality would occur as a result of implementing the no-action alternative. The emissions generated by visitors and staff would not exceed de minimus levels. Temporary adverse impacts from dust might occur during construction activity. Cumulative Impacts: Same as alternative 1.
UNAVOIDABLE ADVERSE IMPACTS	Facility development and provision of a quality visitor experience would increase visitation and change the nature of the experience from what exists today. This might be perceived to be an adverse impact on the monument resources by some groups and individuals. Adjacent residents would no longer be able to access the monument from social trails of their own design. This might be perceived by some adjacent landowners and local residents to be an adverse impact on their ability to enjoy the monument resources. A total of 55 acres of biotic communities, wildlife and wildlife habitat, soils, and associated biodiversity would be adversely impacted by developing visitor facilities and constructing Unser Boulevard. Several archeological sites could be negatively affected by construction, unauthorized visitor use, and vandalism. There would also be impacts on the integrity and character of the cultural landscape resources and on the scenic qualities of the cultural landscape.	Under the National Environmental Policy Act, evaluation of these impacts is not required.		
RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY	Constructing visitor facilities and trails on 55 acres and increasing visitor use of areas now not visited by many people would cause a long-term decrease of natural biological productivity. Although these changes are reversible in the long term and the natural biological productivity could return to the area, it would be unlikely in the foreseeable future, and the extent of adjacent development makes it even less likely. The monument has likely already experienced changes in productivity due to the extent and type of development occurring adjacent to the west mesa.	Under the National Environmental Policy Act, evaluation of these impacts is not required.		
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES	Although all archeological sites would be avoided where possible, or disturbance would be mitigated through the recovery of cultural information and significant artifacts, some losses of archeological objects and cultural information would be likely due to vandalism, illegal collecting, or construction activities. These losses would be irretrievable. Habitat for the <i>Pediocactus pinyracanthus</i> and <i>Mammillaria wrightii</i> would be adversely affected by visitor activity and development. The ferruginous hawk could be eliminated as a breeding species in this area. If all these species continue to decline elsewhere to the point of extinction, this loss would be irretrievable and at least partially attributable to implementing the proposed action. Although most developed areas could be restored to previous conditions over time, the use of land and financial resources to implement the proposed action would, in the practical sense, be an irretrievable commitment of resources.	Under the National Environmental Policy Act, evaluation of these impacts is not required.		

ALTERNATIVES AND OTHER ACTIONS CONSIDERED BUT REJECTED

MANAGEMENT ROLES/ RESPONSIBILITIES

Two distinctly different management models were considered in attempting to determine the appropriate role for the city and National Park Service to play in the monument's daily operation. One model looked at having each agency assume overall control for various geographic units of the monument. Under this model, for example, the city could be solely responsible for the Piedras Marcadas and Boca Negra units while the National Park Service could be responsible for the Atrisco unit. A second model looked at assigning roles based on functional responsibility. Under this scenario, for example, the National Park Service might be responsible for all monument interpretation and the city for all law enforcement. The proposed action calls for a hybrid of these two models.

WEST SIDE ACTION COUNCIL PROPOSAL

As part of the public involvement process for preparing the management plan / development concept plan, an alternative proposal for Petroglyph National Monument was presented at the December 6, 1993, Petroglyph National Monument Advisory Commission meeting by the West Side Action Council, which represents several economic development and neighborhood organizations. The key components of the proposal are as follows:

1. "Urban monument" means effective use of the area with nonrestrictive access and the National Park Service's participation in working out long-term and critical infrastructure needs and active support of approved and in-place

developments outside the boundaries of the monument.

2. The Paseo del Norte extension through the monument is critical to meet Albuquerque's long-term transportation needs and can benefit the monument. The construction can be accomplished in an environmentally sensitive manner.
3. Primary access to the monument should be from the mesa top, and strategies to access through existing, or proposed, neighborhoods should be abandoned. Access should be provided from one end of the monument to another. This approach also provides a higher degree of protection by controlling access. The proposed visitor center location would be southwest of the proposed intersection of Unser Boulevard and Paseo del Norte west of the escarpment.
4. The Native American, Hispanic, and other cultures should be focal points of the educational experience and be integrated with visitor use throughout the monument.
5. The strategies of access throughout the monument should consider ways to enhance economic impacts in the Albuquerque area.
6. New land acquisitions (unidentified) should be limited and considered on a case-by-case basis.
7. The mesa top should be provided with an extensive trail system.
8. The National Park Service should be willing to participate in solving Albuquerque's long-term infrastructure needs.

This management plan / environmental impact statement has incorporated elements of the West Side Action Council proposal that are consistent with the legislation that established the monument and the purposes and significance of the monument. This proposal includes components that have been previously rejected for further consideration or that are contrary to the mission and purpose of the National Park Service and the monument legislation, the legislative history of the monument, and the purpose and significance statements for the monument. The Park Service has responded to each of the above key elements as follows:

1. Petroglyph National Monument, like many other units of the national park system, is within and adjacent to portions of an urban area. As stated in the legislation, federal laws generally applicable to units of the national park system shall apply to the monument. The fact that portions of the monument are within the city of Albuquerque does not diminish the importance of the congressional directive to "preserve for the benefit and enjoyment of future generations." However that proximity in no way diminishes the congressional intent in establishing the monument. There are no special provisions or exceptions of NPS policy that apply to units of the system within urban areas versus rural areas. The only reference to urbanization in the legislation is that the petroglyphs are threatened by urbanization and that there is an urgent need to protect the area from urbanization.

The alternatives address a range of access and public use options consistent with the legislation and monument purposes. Access options addressed in the alternatives include trails for use by pedestrians and horseback and bicycle riders, roads to overlooks, and a variety of parking and trailhead locations.

Alternative 3 incorporates a mesa-top road system similar to the West Side Action Council's proposal. As provided for in the legislation, the National Park Service will participate in land use and transportation planning for lands adjacent to the monument and may provide technical assistance for such planning. Critical infrastructure needs are addressed in the "Utility Rights-of-Way" section.

2. The National Park Service has determined that there is no authority to construct Paseo del Norte through the monument and that there would be significant adverse impacts on the natural and cultural resources of the monument resulting from constructing a four- to six-lane major arterial. There would be no direct benefit to monument visitors. The route would provide the quickest and most direct route through the monument for local traffic. The road would not serve a monument purpose.
3. Preliminary alternatives for visitor use included primary access to the escarpment from the mesa top. This approach was rejected because of the impacts of roads and parking areas on the mesa top and the difficulty in getting from the mesa top to petroglyphs at the base of the escarpment. Alternative 3 incorporates a mesa-top road, but this road does not include primary access to the escarpment. Several escarpment crossing trails would be required that would also have significant adverse impacts on monument resources, including the views, context, and undeveloped nature of the escarpment canyons. Many visitors would have difficulties due to the length of trails required to get to many petroglyph concentrations and the steepness and elevation difference from the base to the mesa top.

None of the alternatives have identified nonlocal visitor access through existing or proposed neighborhoods. Unser Boulevard provides for access from one end of the monument to the other with minimum impact. The West Side Action Council is not specific about how additional protection would be provided by controlling access nor what access controls would be adopted.

Mesa-top visitor center locations were rejected for several reasons: difficulty in interpreting the primary petroglyph resources of the monument to visitors, difficulty in getting large numbers of visitors to petroglyph viewing areas, compatibility of adjacent land uses, additional boundary adjustments and land acquisition would be required, and there would be increased construction expenses due to the difficulty of providing utilities in areas with shallow basalt.

4. We agree that American Indian, Atrisco land grant heirs, and other cultures should be the focal point of interpretive programs.
5. The alternatives do consider ways to enhance economic impacts in the Albuquerque area. However, the monument and the National Park Service have no authority to enhance economic development. Although economic development and tourism may be associated with many units of the national park system, these secondary affects usually occur after the resources have been protected and adequate visitor services and programs have been provided. The private sector would be expected to provide tourist services outside the monument boundary, either independent of or in cooperation with the National Park Service.
6. The alternatives consider several boundary adjustments. Land acquisition policy is addressed in the *Land Protection Plan* (National Park Service and City of Albuquerque 1991). The West Side Action Council proposal did not include how much land would have to be acquired outside the boundary to implement their proposals. It was therefore impossible to evaluate this component of their proposal.
7. The alternatives consider a range of mesa-top trail systems within and adjacent to the monument that are consistent with the nature and character of the mesa top.
8. As provided in the legislation, the National Park Service will participate in land use and transportation planning for lands adjacent to the monument and may provide technical assistance for such planning. See the "Utility Rights-of-Way" section.

OPTIONAL LOCATIONS FOR THE HERITAGE EDUCATION CENTER

Piedras Marcadas Canyon, Southeast Corner

Another possible location for the heritage education center is the southeast corner of the Piedras Marcadas Canyon, north of the Paseo del Norte alignment and west of the Piedras Marcadas arroyo. (This is the proposed site for a visitor contact facility.) This option would combine the visitor contact functions with the heritage education functions. Site modifications would include an expanded parking area with additional space for bus parking and turning areas. From the contact station/education center, trails would guide visitors to petroglyph concentrations near the Alameda grant line, the "alcove," and

several locations within Piedras Marcadas Canyon.

The site is small and hard to get to from the rest of the monument. Adjacent land use would be intrusive and prevent appreciation of the cultural landscape. This area has too much use and development near petroglyph concentrations and too many facilities are being proposed within the monument boundary. There are other more appropriate places where use could be dispersed. Heritage education functions would detract from local use of the area.

The Roberson Ranch Property

Another alternative site for the heritage education center would be immediately south of the Piedras Marcadas Pueblo ruin. This 23.5-acre site, owned by the city, is proposed to be developed as a city visitor contact facility and heritage education center. Monument heritage education functions could be combined with city environmental education programs. The Park Service will continue to work with the city. At this time the city's interest in developing the site is in the conceptual planning stages.

ABANDONED MINE SITE RECLAMATION

The restoration to original contours of the abandoned mine adjacent to Vulcan Volcano was considered and rejected

because of the volume of material required to restore the site to its original condition. There would be excessive costs and unacceptable adverse impacts that would result because of transporting this volume of fill material to restore the site to its original contours. The benefits of restoration to original contours do not justify the costs or the adverse impacts.

BOUNDARY ADJUSTMENTS CONSIDERED BUT REJECTED

Four areas that were considered and rejected for boundary adjustment are the

- area north of the volcanoes
- area south of volcanoes
- area east of Mesa Prieta
- Park West (formally known as Laurelwood)

These areas were rejected from further consideration for a variety of reasons including adequacy of protection under current ownership, lack of known connection to monument resources, and feasibility of adjustment at this time.

AFFECTED ENVIRONMENT



Petroglyph, Piedras Marcadas Canyon



Pear cactus in bloom



Looking east from mesa top

CULTURAL RESOURCES

PREHISTORIC USE

The continuum of human occupation in the Rio Grande valley began some 10,000 to 12,000 years before present and continues to this day. More than 300 archeological sites documenting the full span of human use are found within Petroglyph National Monument. (The following discussion was abstracted largely from Schmader 1988).

Evidence for human use of the west mesa dates back to Paleo-Indian times (circa 10,000 B.C. to 5,500 B.C.) and is primarily documented in the area between the Rio Puerco escarpment and the volcanoes. Only a few scattered traces, primarily stone tools, remain of the early hunters and gatherers who pursued large Pleistocene mammals and made use of the resources near these ancient playa (dry lake beds with no outlet) shorelines.

By around 7,000 years before present, the climate had begun to change and many large mammals became extinct. During this period, known as the Archaic (circa 5,500 B.C. to A.D. 600), human cultures began to rely more on smaller game and seasonal gathering (Schmader and Hays 1986a; National Park Service 1994c).

These Archaic adaptations led to the formation of early Puebloan (Anasazi) cultures. By about 500 B.C. major changes in human use of this area were underway, beginning the gradual transition to Basket-maker and later Pueblo periods that would occur over the next 10 centuries. Cultivation of corn and construction of pithouse habitations and food storage features suggest settled village life. Populations increased, and improved technologies appeared.

During the Pueblo II period (A.D. 900 to A.D. 1100) there was greater reliance on agriculture. Local groups built above-ground linear room blocks as well as major agricultural features such as terraces, rock alignments, and dams that served to divert and hold water. Campsites and lithic quarry sites also reflect specialized prehistoric activities in this area.

Evidence of the Pueblo III period (A.D. 1100 to A.D. 1300) is found at several sites, including the Piedras Marcadas Pueblo.

Increased use of the monument area between the volcanoes and the east edge of the west mesa occurred during Pueblo IV times (circa A.D. 1300 to A.D. 1600), a period of explosive social and technological change. Large multistory adobe pueblos, including Piedras Marcadas in the monument, were constructed along the Rio Grande valley and reflect the complex social and religious organization among pueblos along the river.

Piedras Marcadas pueblo was one of the largest Pueblo IV settlements along the Middle Rio Grande, covering an area of approximately 39,000 square meters. The unexcavated Piedras Marcadas ruin (formerly known as the Zuris-Mann site) is the largest and perhaps the most significant of the sites remaining in the Middle Rio Grande valley. This pueblo complex, of earthen construction, appears to have been inhabited for about 300 years during the Pueblo IV or Rio Grande Classic period. Subterranean kivas reflect the rich and complex religious life of prehistoric inhabitants. There is a great deal of midden debris and an unknown number of pithouse constructions concealed by alluvium covering the site (Marshall 1984).

This Southern Tiwa Pueblo may have been an ancestral village for the present-day Sandia Pueblo people, and the site was almost certainly visited by early Spanish expeditions. Ceramics analysis suggests that the site may have been abandoned during the period of initial Spanish exploration but before major Spanish settlement.

The occupants of this pueblo are thought to have been responsible for much of the Rio Grande style rock art in the monument's Piedras Marcadas canyon (along the escarpment). A prehistoric trail may have connected the pueblo with Los Metates, a prehistoric milling and processing area about 0.75 mile west, and continued to the escarpment and beyond. Thus, this prehistoric settlement forms an integral part of the monument's cultural landscape and is linked with the petroglyphs. It is listed on the National Register of Historic Places.

The ruin is about 0.5 mile from the Rio Grande, bordered by a few houses and a nearby bank. There is no other adjacent development, and the escarpment is visible from the ruin. However, development proposed for lands adjacent to the ruin would create a visual intrusion on the pueblo's landscape and prevent views of the escarpment.

Trails connected the large pueblos in the Rio Grande floodplain with the escarpment and the mesas beyond. No doubt both these areas were vital to the existence of Puebloan peoples for hunting, gathering, agriculture, procurement, processing, and religious activities. Over 300 boulder metates or grinding slicks have been found along the escarpment, especially at Los Metates (outside the monument, but protected by the city Open Space Division) and in selected petroglyph areas. These grinding slicks may have been used for

food processing and for pigments or herbs used for ceremonial or medicinal purposes.

Agriculture-related structures in the monument include water diversion/control structures, catchment walls for agricultural fields, and fieldhouses. Stone rings or shelters, cairns, and walls are also found in the monument.

The escarpment's petroglyphs are the most unique and visible markers of this period. Most of the more than 15,000 petroglyphs along the escarpment are thought to have been created during the Pueblo IV period. A great profusion of masks, faces, anthropomorphs, animals, tracks, hand prints, and geometric designs were left by Puebloan inhabitants of the Rio Grande valley. Some of these petroglyphs may have been created as part of daily subsistence activities, such as collecting and processing wild or domesticated plant foods and collecting the rocks found on gravel benches for stone tool production. Other petroglyphs are thought to have been created during religious ceremonies and may portray events and characters from the Pueblo world or depict various clan symbols.

HISTORIC USE

Although many of the large pueblos along the Rio Grande continued to be occupied until the time of European contact, some had been abandoned at least a century before, probably as a result of factors including overpopulation, drought, warfare, and/or overexploitation of resources.

Members of Coronado's expedition first entered the Rio Grande valley in 1540. They wintered at Pueblo Santiago in the Bernalillo area. It is likely that the Piedras Marcadas Pueblo was occupied at this time and may have been damaged during

fighting between the Puebloans and Coronado's soldiers. The Piedras Marcadas Pueblo was probably abandoned in the 16th century.

The coming of the Spanish and their subsequent expeditions had a massive impact on local populations. During the 1540s, many Indians were killed, and most area pueblos were burned. Although pueblos were reoccupied, strife and disease continued to decimate populations over the next two centuries.

There is little information about land use activities in the monument during the 16th through the 19th centuries. Portions of the monument were, however, included in two early Spanish land grants — the Atrisco and Alameda grants. A portion of the Piedras Marcadas Canyon now within the monument was within the boundaries of the town of Alameda Grant, established in 1710 under a grant by Don Diego de Vargas to Francisco Montes Vigil and included 89,346 acres of land.

The Atrisco grant was established sometime before the Pueblo Revolt of 1680 by members of the Duran y Chavez family near what is now Albuquerque in the Rio Abajo of Atrisco. Following the Pueblo Revolt, the Atrisco grant was reestablished in 1692, including approximately 82,000 acres on the west side of the Rio Grande. Atrisco included the village (collected dwellings and garden plots on individually owned grant lands in the valley), the Ranchos de Atrisco on better bottomland holdings, and the open range/commons of west mesa. West mesa lands were not formally developed as part of the Atrisco or Albuquerque town sites; instead they remained a commons area for livestock grazing. Although there was little change in land use during the succeeding years, increases in the importance of livestock in New Mexico and construction of the

railroad in the 1880s put additional pressure on west mesa lands for grazing.

These land grants facilitated Hispanic settlement throughout the area and were generally occupied by a number of families organized into small plaza-oriented communities or more typically isolated family ranchos. Agriculture and animal husbandry, especially sheepherding on the dry mesa grasslands and the canyons along the escarpment, were critical to the economic success of the ranchos. Archeological remains along the escarpment document use of the west mesa for grazing and seasonal herding camps during the historic period. This pattern of land use continued throughout the 18th and 19th centuries and into the 20th century.

In 1917 the Santa Fe Railway was given "checkerboard" grants for the land around the volcanoes and across the mesa top. This land was subsequently leased to area ranchers for livestock grazing. It was not until the early to mid 20th century that several large private ranches were developed on the west mesa. Portions of what is now within the monument were purchased by Frank Bond and Co., Inc., in 1951 from the former railroad grants.

In the 1920s and continuing until the 1980s, portions of the volcanoes area were leased for surface mining of cinder and scoria (vesicular basaltic lava thrown out of volcanic vents during eruption). A large quarry for cinder gravel was excavated southeast of Vulcan, a smaller excavation was mined from the small cone near Black Volcano, and a third surface mining site is south of JA Volcano. The total area disturbed by the three sites is about 10 acres. Also, during this time exploration for oil and gas deposits was conducted in and around the west mesa area.

In December 1941 the War Department (later the Department of Defense) leased lands on the west mesa and established a 15,246-acre precision bombing range that included targets used by the Kirtland Air Force Base bombardier school. The range extended from just east of the volcanoes to the Rio Puerco Escarpment on the west, and from the southern boundary of the town of Alameda Grant on the north to the northern boundary of the town of Atrisco Grant on the south. At least one of the bombing range target areas is included within what is now the monument. The target areas consisted of fences, mock outlines of industrial facilities, and targets that were bladed into the soil. Remnants from spotting charges and concrete practice bombs have been found near the target areas. The range was used for bombing practice during the period 1941-46. Grazing resumed after the war, and the Atrisco land grant was eventually incorporated as the Westland Development Company, Inc., in 1967 and is about 50,000 acres.

HISTORY OF WEST MESA OPEN SPACE LANDS

Albuquerque enjoys the reputation of having a nationally recognized open space program. Over 40,000 acres of land in Bernalillo County is designated by the *Albuquerque/Bernalillo County Comprehensive Plan* (City of Albuquerque 1988) as major public open space, with 23,000 acres in public ownership. Open Space in Albuquerque/Bernalillo County is defined as any large area of land (or water) that is left largely undeveloped and serves at least one of the following major functions: conservation of natural and cultural resources, protection of the public from flooding or other hazards, provision of recreational services, or satisfaction of psychological needs for space.

The history of the Open Space program spans four decades. In 1961 the city acquired more than 4,000 acres on the west mesa from the Bureau of Land Management, as part of the Recreation and Public Purposes Act. Included in this acquisition were the west mesa lands for the Shooting Range State Park, Grasslands Preserve, and La Boca Negra Park. Interest in protecting Albuquerque's open space was first publicly recognized in the City/County Goals Program of 1969. Throughout the 1970s, a desire to protect the open space lands on Albuquerque's west mesa grew as citizens became interested in acquiring the Sandia Mountain foothills, Rio Grande Bosque, and other specific open space lands.

Even before the 1975 and 1988 Albuquerque/Bernalillo County comprehensive plans or establishment of the monument, acquisitions of the northwest mesa's lava flows were proposed. The city acquired the 70-acre Indian Petroglyph State Park in 1972, prompted by a local park dedication ordinance. Matching state and federal funds were later used for park development. In 1973 Albuquerque's City Commission approved acquisition of 1,883 acres on top of the mesa including the three southern volcanoes, using matching federal funds from the Land and Water Conservation Fund. Shortly thereafter, in 1976, the two northern volcanoes containing 440 acres were acquired using the same federal matching source of funds; these lands became known as Volcano Park. A third matching grant from the federal government in 1978 matched city funds to acquire 2,120 acres from the owners of the Bond Ranch between the volcanoes and La Boca Negra Park.

Although the city has been acquiring open space lands for decades, acquisition needs far exceed available funds. Major open space acquisitions below the volcanic escarpment did not occur until the city began purchasing land in Piedras

Marcadas Canyon in 1983. The first formal Open Space program was established in Albuquerque in 1984 with the formation of the Open Space Advisory Board, an appointed citizen's board that, along with staff, is charged with reviewing and approving acquisition priorities and additions to the system. In addition, the board advises the Environmental Planning Commission and the mayor and makes recommendations regarding extraordinary facilities, open space plans, and proposals to sell lease or acquire lands using open space funds.

In 1986 the board placed approximately 3,120 acres along the escarpment in their highest priority group for acquisition in 1986. Nomination of the Las Imagines Archeological District to the National Register was completed in 1986 and includes the escarpment and 50+ meters from the escarpment face. Subsequently, the *Northwest Mesa Escarpment Plan* (City of Albuquerque 1987), adopted by the City Council in 1987 and the County Commission in 1988, recognized the importance of the escarpment, adjacent open space, and the Zuris-Mann (Piedras Marcadas pueblo ruin) site, purchased in 1988 by the city.

After the establishment of Petroglyph National Monument in 1990, the city has continued to acquire lands in and adjacent to the monument. A primary source of funding for the recent land acquisitions is the Open Space fund. Another major source of funding for acquisition of major public open space is the use of the "Quality of Life" funds, generated through a temporary increase in the city's gross receipts tax, which was approved by the voters and expires in 1997. City-generated tax revenues allocated to purchases within the monument have been \$13,800,000.

Several individuals and groups have continued to work hard to raise awareness of and protect Albuquerque's open space

system. Groups such as the Committee to Save the Volcanos, Open Space Task Force, West Mesa Committee, and Friends of the Albuquerque Petroglyphs have been involved in land protection efforts to establish a strong land base. These groups recognized the importance of protecting Albuquerque's western horizon, the volcanic cones, and the escarpment. The success of the open space program is largely due to their efforts.

NATIONAL REGISTER OF HISTORIC PLACES

The entire area encompassed within the monument was added to the National Register of Historic Places in 1990 though the passage of the monument legislation by Congress. Separate national register nominations had been prepared previously for Boca Negra Cave, Piedras Marcadas Pueblo ruin (Marshall 1984), and the Las Imagines Archeological District (the west mesa escarpment) (Schmader and Hays 1986b). The monument appears to be eligible for listing on the National Register of Historic Places as a cultural landscape.

CULTURAL LANDSCAPE

Cultural landscapes are defined as geographic areas, including both cultural and natural resources, associated with an event, activity, or person or exhibiting other cultural or aesthetic values. The lands included within the boundaries of the monument represent a conglomerate of several types of cultural landscape resources.

Cultural landscape resources include natural features such as the volcanoes, caves, promontories, and special plants and minerals and cultural features such as petroglyphs, archeological sites, and shrines. Other character-defining features

associated with prehistoric activities include agricultural fields along the river bottoms and on the natural terraces found along the escarpment and the broad sweeping grasslands of the mesa top and below the escarpment. Important physiographic features such as the Sandia Mountains and Mount Taylor are visible from the monument and, for the Pueblo Indians, are spiritually linked to it. It is the combination of these elements and the spiritual meaning they convey to contemporary traditional cultures that helps define this cultural landscape.

Many of the beliefs, customs, and practices of Pueblo peoples that have been passed down through the generations, both orally and through practice, are reflected in the sacred sites within the monument. The monument encompasses places where traditional religious practitioners have gone to perform ceremonial activities or gather special medicinal plants.

Resources that help define the character of this landscape include the fences, survey markers, and landforms that formed visual and legal boundaries of the area, including brush and stone corrals, and acequias (irrigation ditches). Other features include stock tanks, target ranges, and mining pits.

The potentially significant cultural landscapes that have been identified during a cultural landscape overview are detailed in appendix G and the *Petroglyph National Monument Cultural Landscape Overview* (National Park Service 1994a).

ARCHEOLOGICAL SITES

Within the monument, more than 15,000 petroglyphs and more than 300 archeological sites have resulted from centuries of human use. There are significant prehistoric archeological sites in the monument such as terraces, walls, and field

houses in association with major concentrations of petroglyphs. Although most of the lands in the monument boundary have been inventoried, past surveys have varied in their coverage, research design, reporting, analysis of data, and terminology — leading to conflicting and confusing definitions of sites and their contents. Most archeological sites have been defined by the presence of surface materials.

The most visible and prolific archeological sites include petroglyphs found throughout the escarpment, in the geologic windows, and on rock outcrops. Although some petroglyphs are thought to date to the Archaic period, most are probably Anasazi or Puebloan in origin. Others, containing brands, initials, dates, and crosses, are associated with the historic period.

Three of the 13 Paleo-Indian sites identified on the mesa lie within the monument. These sites include lithics and debitage (debris from making stone tools) and fire-cracked rock.

Thirty Archaic sites/site components have been identified within the monument. Site features and artifacts include petroglyphs, grinding stones, occasional stone tools and scattered tool manufacturing debris, and evidence of campsites and procurement and food processing areas such as ash stains, fire-cracked rock, and grinding stones.

Two Basketmaker sites were reported from the mesa top/volcanoes area.

A number of caves, lava tubes, and rock shelters, which were created by volcanic activity, are in the monument. Like the volcanoes, the monument's caves are thought to hold spiritual and cultural meaning for contemporary Pueblo peoples. The most significant of these features is Boca Negra cave. This cave is an important

multicomponent site containing early as well as late Archaic materials and maize cobs and squash remains radiocarbon dated A.D. 370 $\pm$ 168 (Reinhart 1968). This cave also contained evidence for the transition between Archaic adaptations and emergent Puebloan horticultural developments.

Only seven of the 129 Anasazi or Puebloan sites/site components within the monument are identified as belonging to the Pueblo I through Pueblo III periods; 62 Pueblo IV sites and four Pueblo V sites were reported for the area. Surveys done in 1992 and 1993 identified an additional 67 sites/site components as "prehistoric."

Some Puebloan occupation sites are quite complex, containing lithics, ceramic sherd concentrations, rock alignments, agricultural fields and water diversion structures, cairns, and stone rings and rubble. (The rubble may be remains of structures or may have come from agricultural uses.) The Schmader and Hays (1986a) and Schmader (1986) surveys along the escarpment found seven sites with agricultural terraces, 12 water/soil control features, and three possible field houses, all probably constructed during the Pueblo IV period. (Field houses are small, sometimes temporary structures built close to agricultural areas to provide shelter for farmers.)

Many water control features are situated along and just below the escarpment itself, where prehistoric inhabitants could easily channel runoff into agricultural fields. More subtle water control features (rock alignments used as check dams and grid gardens) occur on the mesa top when deeper alluvial concentrations made agriculture feasible. Rock shelters often had petroglyphs associated with them, and several had sherd, lithic, and/or ground stone scatters and grinding areas present. Stone alignments, possibly habitation units, may be found near the escarpment.

Smaller sites appear to be related to specialized activities such as camping or food procurement and processing. About 25% of area sites had ash stains, fire-cracked rocks, and/or hearths. Many lithic scatters are relatively small in area, but quarrying/procurement and manufacturing sites may occupy a fairly sizeable acreage. These site types are generally in areas where raw materials such as gravel are readily available, especially in the Mesa Prieta area.

The most striking evidence of procurement specialization (making tools) is the lithic-reduction quarry site. Large gravel outcrops of igneous rocks (from the Santa Fe formation) occur on benches below the escarpment. Petrified wood, chalcedony, chert, quartzite, rhyolite, and basalt cobbles collected from the benches were broken apart by prehistoric toolmakers who left behind the larger, less useful lithic debris. The most useful stones were taken to make into stone tools. This multistep process is evidenced by the progressively finer lithic debris found at occupational sites across the west mesa.

The age and cultural affiliation of some of the monument's sites are "unknown"; these sites generally include rock alignments or cairns on the mesa or along the top of the escarpment. Hearths and ash stains are frequently present. Because lithics are present at several sites, these sites are likely to be either prehistoric or early historic. A few sites reportedly document continued use of the area by historic Pueblo groups following European contact.

A total of 158 site components have been identified as "historic." Four of these are classified as post Spanish in nature, while another 15 predate World War II and appear to be associated with area ranching and grazing between about 1875 and 1940. Most of these historic sites are sheep corrals/pens and are probably related to

Hispanic occupation of this area. Areas along the escarpment such as Rinconada Canyon provided excellent natural shelter and grazing for livestock.

Historic petroglyphs dating between ca. A.D. 1598 and A.D. 1900 and thought to have been created by the land grant herders using the monument area include livestock brands (symbols and alpha-numeric designations), Christian crosses, name initials, and family emblems. These inscriptions are associated with archaeological sites such as linear and circular dry-laid (unmortared) masonry wall alignments used as shelters and livestock corrals. Herding sites also include

stone and brush corrals, walls, cairns, campsites, lambing pens, debris scatters and dumps, and brands and initials etched into rocks along the escarpment. It is clear that before about 1950, most activities in the monument area related to herding and ranching. Several structural remains, including footings and walls, reflect brief, scattered occupation of the area during the late 19th or first half of the 20th century.

Eighty-seven historic site components date to World War II and later. Of these, two are shooting range targets and eight are military features such as concrete "dummy bombs."

NATURAL RESOURCES

AIR QUALITY

Air quality is an important resource that directly affects the visitor experience. The Clean Air Act (42 USC 7401 et seq.) was amended in 1977 to, among other things, preserve, protect, and enhance the air quality in national parks, wilderness areas, and other nationally significant areas — such as Petroglyph National Monument. The monument is designated as a class II clean air area under the 1977 amendments. Class II designation permits modest industrial growth in the vicinity of the monument, but the air quality standards (increments) established for class II areas are still more stringent than the national ambient air quality standards (NAAQS). The Clean Air Act was amended again in 1990, and those amendments retained and enhanced the park and wilderness protection provisions.

Petroglyph National Monument is in the Albuquerque-Mid Rio Grande Intrastate Air Quality Control Region in New Mexico. As of July 1993, this region is maintaining the national ambient air quality standards for all regulated air pollutants except carbon monoxide; the region is classified as nonattainment for carbon monoxide. However, this status may soon be reviewed and changed to reflect three consecutive years without violation of these standards. According to Steven W. Walker, manager, Air Pollution Control Division, Albuquerque Environmental Health Department, stationary sources account for about 5% of the air pollution in this air quality control region, and automobile and other mobile sources account for the rest. There are no major stationary sources on the west side of the river near the monument. The city maintains 11 monitoring sites, which measure carbon monoxide, ozone,

inhalable (fine) particles, and oxides of nitrogen. The nearest monitoring site to the monument is near the intersection of Coors and Corrales Roads (pers. comm. 12/21/93.)

Ozone, a secondary air pollutant that results from the chemical transformation of volatile organic compounds (hydrocarbons) and oxides of nitrogen in the presence of sunlight, is a growing problem in Albuquerque. The street system near the monument currently does not allow efficient traffic movement, resulting in increased auto emissions and higher ozone concentrations (pers. comm. 12/21/93.)

NOISE

Noise levels in the monument vary depending on time, wind direction, and location. In the interior of the Piedras Marcadas and Rinconada Canyons there is generally far less noise than at the base of the escarpment near adjacent developments and above the escarpment near the model airplane field. Airplanes landing and taking off from the Double Eagle II Airport are other sources of noise in the monument.

Noise levels were identified at several locations in or near the monument in a study done for the *User Middle Transportation Corridor Study, Final Environmental Impact Statement* (Leedshill-Herkenhoff, Inc. 1992). Background noise was identified from distant traffic, aircraft flyovers, barking dogs, and transformer noise. A study conducted by monument staff in 1993 and 1995 measured 21 sites within the monument for level and source of noise present. Of the 21 sites measured, Boca Negra Canyon and the Las Imagines Visitor Center had the highest noise levels,

and those with the lowest were Rinconada Canyon, Piedras Marcadas Canyon, and the volcanoes parking area. Aircraft activity was noticed most often at the northern geologic window and Bond Volcano. Other urban-related noise was evident at almost all locations below the escarpment with the exception of the Piedras Marcadas Canyon and the inner Rinconada Canyon. Noise measurements have not been taken at Mesa Prieta or the southern geologic window.

VISUAL RESOURCES

The mesa top offers panoramic views of Albuquerque and the surrounding environment. Western views encompass the volcanic cones. From the volcanic cones the landscape opens outward to the valley of the Rio Puerco, with Mt. Taylor (north of Grants) visible in the distance. Eastern views include the city, the cottonwood forest lining the Rio Grande (the Bosque), and further east the Sandia and Manzano Mountains. Views to the north include the Ortiz, Sangre de Cristo, and Jemez Mountains. The face of the escarpment generally forecloses vistas from the base, but the southern volcanoes can be seen from Rinconada Canyon. From the escarpment base the views to the east of the Bosque and the Sandia Mountains are often blocked by adjacent development. However, from the mesa top adjacent residential development is less prominent. In the lower Piedras Marcadas and Rinconada Canyons, the walls block all but eastern views; in contrast, a series of rolling ridges at the base of Mesa Prieta block all views of the city, creating a sense of isolation.

Another major aspect of the visual quality of the monument is the importance of the mesa, escarpment, and volcanoes as part of the view from Albuquerque. The

monument is a major landscape feature that helps to frame the city.

Several features affect the scenic quality. Three major transmission lines, owned by Public Service Company of New Mexico, Plains Electric Coop, and El Paso Electric, cross through the monument. These lines provide power to Albuquerque from the Four Corners area. A major substation is also on the southeastern edge of the monument, as is a large water tank.

Several residential developments abut the monument and are clearly visible from the monument, including Santa Fe Village, High Range, Shenandoah, and Las Marcadas. Unser Boulevard runs along the base of the escarpment and there are plans for Unser to cross through the monument. Atrisco Drive is a major cut in the escarpment; eroded trails on the escarpment are also clearly visible at Lava Shadows, just south of Boca Negra and adjacent to many of the neighborhoods. Extensive dumping has occurred at the west end of the Piedras Marcadas Canyon. Sporadic dumping has occurred along dirt roads adjacent to the monument. There are scars from off-road vehicles and ranching roads throughout the monument.

Other developments in the future could affect scenic views, such as development of the Westland Development Corporation, Inc. lands to the south, expansion of the Double Eagle II Airport, and development of the Volcano Cliffs, Shenandoah, and Las Marcadas subdivisions.

The Piedras Marcadas Pueblo ruin has vacant land around it except for a few residences and a bank. The escarpment can be seen from the site, as well as the Rio Grande valley and the Sandia Mountains. Several development proposals are under consideration by the city for high density housing near the site.

GEOLOGY

Petroglyph National Monument lies within the Albuquerque Basin, one of the world's great troughs. The basin has been subsiding over the past 10 million years and filling with sediment eroded from surrounding regions. The Santa Fe formation, which underlies the basalt and other surface deposits on the mesa and terraces at the base of the escarpment, accounts for most of the first several thousand feet of sediment. It consists primarily of unconsolidated to loosely consolidated fine-grained sand, silt, gravel, and clay deposited in the Rio Grande depression. The gravel includes quartzite, quartz, chalcedony, chert, petrified wood, rhyolite, basalt, and granite cobbles.

The basalt in the monument was deposited approximately 190,000 years ago ($\pm 40,000$ years) (Bachman & Menert 1978), when molten lava rose through a fissure in the uplifted mesa and flowed east toward the ancestral Rio Grande. Because of the difficulty in dating geologically recent basalt, it is possible that the monument lava flows are as young as 110,000 years old (University of New Mexico, John Geisman, geology professor, pers. comm. 1994). Six separate flows erupted in rapid succession. The earlier flows were relatively fluid and may have reached the river. Later flows were more viscous and moved only a few hundred feet from the fissure. The last series of small, explosive eruptions built up the five volcanic cinder cones that are visible today along the original fissure as well as numerous smaller cinder outcrops called spatter cones or nubbins.

The basalt caprock, varying from 2 feet to more than 38 feet thick (Vineyard & Associates Inc. 1992), has been undercut by weathering and modern streams, exposing underlying sands and gravels. The escarpment is retreating slowly to the west as

these less-resistant sediments erode and blocks of basalt at the rim break along joints and tumble down the steep slope.

At Mesa Prieta, Rinconada Mesa, and Marsh Peninsula, narrow promontories of lava rock jut out from the escarpment. These reveal where lava followed ancient streambeds. The lava here was thicker and more resistant to erosion than the surrounding materials.

The true color of the west mesa basalt is a light gray that can be seen on rocks that have chipped or cracked surfaces. When the rock surfaces are exposed to air over time they become coated with a thin, black layer of iron and manganese. This is called "desert varnish." (There is also evidence that desert varnish can be formed by manganese-oxidizing bacteria.) This was the surface most frequently used for carving the petroglyphs. Thus, to make a petroglyph, the rock surface with the desert varnish patina was pecked, chipped, scratched, or abraded in a manner that removed the desert varnish and exposed the lighter gray color of the basalt. When the basalt boulders are turned over, however, the bottoms are crusted with a layer of white calcium carbonate or caliche. The white surfaces of overturned boulders stand out in stark contrast to their dark surroundings.

The northern and southern geologic windows in the middle of the west mesa are believed to have been hills of soft sedimentary materials (they could have been sand dunes) that were surrounded by the lava flows. The windows formed when these sedimentary hills were eroded away by the Boca Negra arroyo, leaving depressions in the terrain. These depressions reveal different lava flows and the underlying sediments, providing a window into the geologic past. There is a "middle" window that is not within the monument because there are few petroglyphs, there

are no other sites of cultural value or significance, and the site has been severely impacted by illegal dumping, offroad vehicle use, vandalism.

The five volcanic cones — JA, Black, Vulcan, Bond, and Butte — are extinct. JA, Black, and Vulcan are the highest cones and illustrate clearly the characteristics of the final eruptions. The sides of JA and Vulcan are composed in some places of crumbly cinder and in others of dense lava, reflecting alternating cinder eruptions and viscous lava flows. JA contains the most diverse, colorful mixtures of lava, spatter, and cinder of all the cones. It also has a small lava cave, "dribble flows" that resemble candlewax in form and behavior, and a tongue-shaped lava flow that formed when the lava in the crater broke through the rim.

The monument is in and adjacent to the Rio Grande rift, which is an active earthquake belt. In the last 100 years the Rio Grande rift has experienced several hundred earthquakes, but most rarely exceed a magnitude of 3 on the Richter scale; none have exceeded magnitude 5.

The only known mineral resources in the Albuquerque area are scoria (loose cinder-like lava) and sand and gravel. (Sources: National Park Service 1988; Schmader 1988; City of Albuquerque 1987; MTK Inc. 1991) Past use of the monument included mining of scoria near the volcanoes. Mining no longer occurs in the monument; however, abandoned pits remain.

SOILS

The common parent materials for all of the soils found in the monument are basalt and fine alluvial silt and sand. Sand is common in the area and is frequently deposited by wind. On the mesa top, soil varies in depth from zero on the

escarpment rim and volcanic cones to more than 5 feet in broad areas of little slope.

Five major soil types overlie the basalt along the upper edge of the escarpment. The predominant type is Alameda sandy loam, a well-drained soil that occurs on slopes of 0% to 5% from the Piedras Marcadas Canyon to Mesa Prieta. The fine sandy loams of the Madurez-Wink association are deep and well-drained. They occur on slopes of 1% to 7% along the upper edge of the escarpment south of Boca Negra to Marsh Peninsula and north of Mesa Prieta. The Akela-Rock outcrop complex consists of rock outcrops and coarse, gravel loam; basalt is exposed throughout 20% of the complex. It occurs on slopes of 1% to 9% along the upper edge of the escarpment north of Boca Negra and north of Rinconada Canyon.

The rock outcrop-Akela complex is on the volcanic cinder cones, on 10% to 50% slopes. The Akela soil component, a stony sand loam, is in areas between the rock outcrops. The Latene sandy loam, a deep, well-drained soil, occurs on slopes of 1% to 5% along the upper edge of the escarpment south of Boca Negra. The face of the escarpment is predominately the Kokan-Rock outcrop association. The Kokan soil component is a gravelly sand that occurs on slopes of 25% to 45% near the base of the escarpment.

The predominant soil association along the base of the escarpment is the Bluepoint-Kokan association. Both of these sand/gravel loams are deep and very well drained. The Kokan component occurs on slopes of 15% to 40%, while the Bluepoint component occurs on slopes of 5% to 15%. Bluepoint loamy fine sand occurs on slopes of 1% to 9% at the base of the escarpment in the Piedras Marcadas Canyon area.

Many of the monument's soils have development constraints. Vertical joints along the rim of the escarpment are planes of weakness, and as the soft sediments below the basalt are weakened by water passing down the joints, blocks of rock detach and roll down the slope. The mesa-top soils tend to be shallow with low density and are susceptible to wind erosion, which limits their use for developments. Piping (formation of horizontal conduits below the surface) could be a problem if soils are locally saturated for extended periods.

The soils below the escarpment also have characteristics that can limit development. Especially along the northern and central parts of the escarpment, the soil is fine silt and sand, which is highly erodible, especially on steep slopes.

There are no prime or unique agricultural lands, as defined by the U.S. Department of Agriculture, Soil Conservation Service, in Petroglyph National Monument (Soil Conservation Service, J. Warner, pers. comm. 1992). (Sources: National Park Service 1988; U.S. Department of Agriculture, Soil Conservation Service 1977; City of Albuquerque 1987).

WATER RESOURCES

There is no standing surface water in the monument, although there are two relatively small playas (closed basins with no outfalls) in the Piedras Marcadas Canyon area and one in the Lava Shadows area. During small storms these playas fill with water; however, in larger storms the playas overflow to adjacent watersheds that drain to the Rio Grande.

The area west of the escarpment can be generally characterized as having broad drainage swales with several intermittent streams or arroyos. Seven arroyos and

their branches drain the escarpment: Piedras Marcadas, Mariposa, Boca Negra, San Antonio, Rinconada, Ladera, and Mirehaven. These arroyos can be grouped into four major watersheds: Piedras Marcadas, Mariposa/Boca Negra, San Antonio, and Ladera. All of the arroyos flow in an eastward or southeastward direction to one of several escarpment crossings. Below the escarpment, storm runoff flows through city, Albuquerque Metropolitan Arroyo Flood Control Authority, and Middle Rio Grande Conservancy District facilities and eventually drains into the Rio Grande.

In semiarid climates, arroyos generally carry large amounts of sediments with rainfall runoff. Most sediment is picked up from the arroyos' banks and beds along steep or narrow reaches where velocities are high and deposited at a point where the arroyos widen out or the slopes are milder. There is abundant evidence of historical flows scouring the escarpment where arroyos cross the escarpment as part of a natural process.

Erosion damage on the escarpment is also occurring due to development adjacent to the monument, which has affected the area's drainage patterns and increased runoff above historic rates. In particular, gravel roads adjacent to the monument and informal trails can concentrate and increase runoff to cause erosion of wind-deposited sands along the escarpment.

Grazing on the west mesa, together with the gravel roads, has exacerbated erosion. In some cases, archeological sites in soft sands adjacent to arroyos have been partly destroyed by erosion.

The Rio Grande trough (20,000 feet deep) is a natural underground reservoir for an immense volume of water. The monument is a recharge area for this aquifer. Precipitation permeates through fissures in the

basalt flow and enters the thick, porous, Santa Fe formation, through which water moves with relative ease. The rate of recharge is especially high along the base of the escarpment. The depth to groundwater is estimated to be as much as 800 feet below the surface of the mesa above the escarpment, and as little as 160 feet under the surfaces of the terraces below the escarpment.

Groundwater is the sole source of public drinking water supply in Bernalillo County. The water quality is generally good, requiring little treatment before use. In some portions of the county, including the west mesa, the water quality is below acceptable drinking water standards. The city and county have prepared a *Ground-Water Protection Policy and Action Plan* (City of Albuquerque 1993c) to address these issues.

FLOODPLAINS AND WETLANDS

Although the sparse precipitation in most places is almost immediately absorbed by the monument's porous soils, the arroyos can flood during intense summer thunderstorms that can produce more than 1 inch of rainfall in 30 minutes. Dangerous flash floods are possible in the arroyos, which should be considered high hazard areas. The Federal Emergency Management Agency has mapped the monument area for flood insurance rates. Community panels 350002-0020, 021, 0013, 0014, 0007, and 0008 show the 100-year flood boundaries for the monument; 500-year flood boundaries have not been mapped.

All of the arroyos and their branches in the monument have 100-year flood boundaries that generally coincide with the arroyos' banks and average about 100 feet or less in width. The Mirehaven arroyo in the southern tip of the monument, where it bends around the escarpment, has a broader flood boundary, approximately 250 feet in width. There is a much larger 100-year flood boundary north of the training dike at the southern base of the escarpment: at its maximum, the flood boundary is about 1,500 feet wide. Northwest of Butte Volcano there is another relatively large, flat area, about 100 to 700 feet in width, that falls within the Boca Negra north arroyo's 100-year flood boundary. A small portion of the Piedras Marcadas Pueblo ruin area is within the 100-year floodplain of the Piedras Marcadas arroyo, which may have shallow flooding of 1-2 feet.

According to the U.S. Fish and Wildlife Service's national wetlands inventory maps, the monument has wetlands, the vast majority of which coincide with the arroyos and are classified as riverine intermittent streambeds.¹ There are also small, isolated palustrine scrub-shrub, lacustrine-littoral-unconsolidated bottom, and palustrine-unconsolidated bottom wetlands identified on the maps. (Sources: Leedshill-Herkenhoff, Inc. 1992; Federal Emergency Management Agency National Flood Insurance Program Floodway, Flood Boundary, and Floodway Maps for the City of Albuquerque 1983; U.S. Fish and Wildlife Service National Wetland Inventory maps.)

¹ The U.S. Fish and Wildlife Service notes that riverine intermittent streams may not meet the definition of wetlands. In addition, it should be noted that the arroyos and playas on the monument are ephemeral and do not stay inundated long enough for hydric soils to evolve or for hydrophytes to establish themselves. Thus, under the hydrology, hydric soil, and hydrophytic vegetation criteria of the *Federal Manual for Identifying Jurisdictional Wetlands* (1989), there are no jurisdictional wetlands in the monument (U.S. Fish and Wildlife Service, Albuquerque, Chuck Mullins, pers. comm., Feb. 28, 1992).

VEGETATION

etroglyph National Monument's vegetation has not been completely inventoried. The monument's flora is influenced by the Great Basin Desert, Rocky Mountains, Sonoran Desert, Great Plains, and the Rio Grande. Two grassland and two mixed shrub grassland native plant communities were identified in this area by the Soil Conservation Service in 1977 (U.S. Department of Agriculture, Soil Conservation Service 1977). A survey done in 1993 and 1995 identified some species in the monument that are usually found much further south.

Most of the plant communities in the monument have been disturbed by heavy grazing, off-road vehicles, and other human activities. Consequently, many of the monument's prominent plants are exotic species that thrive once an area has been disturbed. These species would seldom be dominant in natural communities. (Russian thistle, snakeweed, and summer-cyprus are three species that may need to be controlled in the monument.) The vegetation of the northern geologic window is relatively undisturbed.

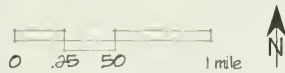
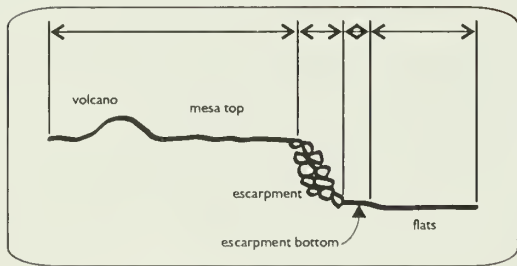
Most of the plant biomass on the mesa top consists of perennial bunchgrasses, with some shrubs and annual plants. Black grama and galleta are the dominant grasses, and saltbush, winterfat, and Apache-plume are the dominant shrubs. In areas where the soil is sandier, the drop-seeds and Indian ricegrass are likely to dominate. (Indian ricegrass is particularly common on the deep soils of the geologic windows.) In disturbed areas, black grama is less abundant, while sand drop-seed and broom snakeweed are more common. Some of the rockier, less accessible areas appear to be close to natural conditions because they have been little disturbed by recent grazing activity.

The arroyos support several species of shrubs and the only tree species found in the monument. Four-wing saltbush tends to be abundant near the arroyos, while Apache-plume lines stretches of the arroyos. Thickets of skunk-bush also occur in arroyos. One-seeded juniper trees define many of the arroyo cuts below the volcanic cones. Some of these juniper may be very old (Paul Knight, botanist, pers. comm. 1992).

The face of the escarpment supports a mixed shrub grassland. Black grama and bush muhly are the dominant grasses, and four-wing saltbush and sand sage are the dominant shrubs. On south-facing slopes the woody shrub *Parthenium incanum* is fairly common, as is at least one species of thin-stemmed brickelbrush. In disturbed areas along the escarpment, annual species and shrubs increase in number and size. Prickly pear and chub-cholla cacti are present.

A mixed shrub grassland also occurs at the bottom of the escarpment and the sandy flats extending out to the monument boundary (the flats) (see Ecological Zones map). Indian ricegrass and sand sagebrush are normally the dominant species, but grazing and other human activities have reduced the grass and increased such shrubs as sand sagebrush, rabbitbrush, broom snakeweed, and Russian thistle.

Those ecological zones — mesa top, escarpment, escarpment bottom, and flats — create "edge zones" where the zones meet. These edge zones provide a broad variety of microhabitats for plants and animals that prehistoric peoples used. These microhabitats exist partly because the east-facing slopes of the escarpment are sheltered from the prevailing westerly



Ecological Zones
Petroglyph National Monument
 United States Department of the Interior
 National Park Service
 DSC • August 95 • 354 • 20,011

mesa top

escarpment

escarpment bottom

flats

winds and because the black rock holds and disseminates heat from the sun.

The long narrow zone made up of the escarpment, slope, and sandy dune flats directly below the escarpment are places where many species interact. The dark color of the basalt causes absorption of heat during the daylight hours. The sandy gravel underlying the boulders holds water for several days, especially after summer rainstorms. An environment is created that favors longer growing periods, resulting in denser plant growth that provides good wildlife habitat. This creates an ecotone that is rich in biodiversity compared with the mesa top. The adjacent flat lands also provide good habitat for many species of wildlife, including birds, jackrabbits, coyotes, and rodents.

WILDLIFE

Detailed information is not available on wildlife populations that occur in Petroglyph National Monument. West mesa animals are typical of the upper Chihuahuan Desert. Some animals are year-round residents; others, especially birds, may be present only during the migration or breeding season. Although the monument may appear to not support many wild animals, most mammals and reptiles and some invertebrates are nocturnal — they are not apt to be seen during the day. The populations of some animals, particularly mammals such as pronghorn antelope, are declining on the west mesa as development and human activity increase (National Park Service 1988).

The most common mammals in the monument area are rodents and rabbits. Rodents are found in all of the west mesa habitats. Common species include the whitethroat woodrat, rock squirrel, prairie dogs, kangaroo rat, white-tailed and

antelope ground squirrels, rock pocket mouse, deer mouse, and white-footed mouse. Black-tailed jackrabbits and desert cottontail are also common, living in open areas above and below the escarpment.

Other mammals found in the area include bats such as the western pipistrell that roosts in rock cavities along the escarpment. A herd of pronghorn antelope occasionally forages west of the monument. Prairie dogs are found along the western boundary. Other carnivores that may be found in the monument include coyote, badger, and striped skunk. Reptiles are widely distributed throughout the monument. Lizards, such as whiptails, side-blotched, prairie, lesser earless, eastern fence, leopard (collared), and horned lizards, are plentiful most of the year. Snakes that are common in open areas include the bull snake, western coachwhip, and prairie rattlesnake.

Resident and nonresident birds are also well distributed through the monument. A total of 106 bird species were identified in the monument, primarily along the escarpment, in Piedras Marcadas and Rinconada Canyons and the northern and southern geological window. Some of these are year-round residents, some may be year-round residents, some are summer residents, some are winter residents, and some are migrants. Thirty-five of these species have been observed nesting or are believed to be nesting on the monument (Schwarz 1993). Common nesting species include scaled quail, horned lark, eastern and western meadowlark, rock wren, canyon wren, loggerhead shrike, crissal thrasher, common and Chihuahuan raven, common nighthawk, canyon towhee, rufous-crowned sparrow, and black-throated sparrow.

Great horned owls can often be found on the monument's rocks and cliffs. The red-tailed hawk, northern harrier (winter), and

American kestrel are common on the mesa top and in the open areas below. The Mesa Prieta cliffs are good raptor habitat; red-tailed hawks, prairie falcon, and American kestrel may all nest here. An active golden eagle nest was found in the Mesa Prieta area in the mid 1970s.

Insects and other invertebrates are found in all parts of the monument. Several species of spiders, sun spiders (solpugids), and scorpions occupy habitats both in rocks and in open areas. The escarpment supports a thriving population of the common desert millipede *Orthoporus ornatis*. Other numerous invertebrates in the monument include darkling beetles, leafhopper bugs, grasshoppers, camel crickets, and harvester ants. (Sources: National Park Service 1988; Crawford 1991; Leedshill-Herkenhoff, Inc. 1992; Paul Knight, botanist, pers. comm. 1992; City of Albuquerque 1987; Hart Schwarz, local ornithologist, pers. comm. Jan. 31, 1994.)

THREATENED AND ENDANGERED SPECIES

Of the 13 bird species listed by the U.S. Fish and Wildlife Service as threatened, endangered, or category 2 (those species for which the U.S. Fish and Wildlife Service has information indicating the possible appropriateness of listing but for which further information is still needed) species for Bernalillo County, four species have been seen in the monument — the bald eagle, ferruginous hawk, southwestern willow flycatcher, and whooping crane. Section 7 of the Endangered Species Act does not require protection of category 2 species or their habitat. However, the U.S. Fish and Wildlife Service requests consideration of these species and their habitat, and NPS policy directs that these species be treated as if they are listed species.

The bald eagle is a winter resident in this area, but no nesting habitat occurs in the monument. Whooping cranes were seen migrating through with sandhill cranes in the winter of 1993. The southwestern willow flycatcher was seen in 1990; however, no habitat exists in the monument to support it. The ferruginous hawk and western burrowing owl are category 2 species. There is potential nesting habitat for the ferruginous hawk in the monument. The western burrowing owl has been observed near the monument. Black-footed ferrets historically lived in Bernalillo County, but none have been seen in the county since the 1920s. Black-footed ferrets are listed as endangered on the federal list.

The mountain plover (a category 1 species) has been observed on shortgrass prairie north of Albuquerque and may occur in the short grasses on the monument's mesa top. (Category 1 species are those species for which the U.S. Fish and Wildlife Service has substantial information to support their listing as threatened or endangered and the development and publication of proposed rules for these species are anticipated.) There is a chance the plover could breed in the monument, but more likely it is a migrant.

An unusual millipede, *Toltecolus chihuensis*, is also a category 2 species. This millipede was found in the former Petroglyph State Park and along the south-facing base of the escarpment in Rinconada Canyon. Its only other known occurrence in the world is at the city of Chihuahua, Mexico. The millipede apparently lives in very sheltered areas, beneath volcanic boulders and at the base of cliffs (University of New Mexico, Dr. Clifford Crawford, biologist, pers. comm. 1994).

The state maintains a list of state endangered animals and plants and a list of rare and sensitive plant species. Both

the peregrine falcon and grama grass cactus are classified as state endangered species. According to the New Mexico Natural Heritage Program, five plant species classified as rare and sensitive also potentially could occur in the monument: Santa Fe milkvetch (*Astragalus feensis*), dune unicorn plant (*Proboscidea sabulosa*), Wright's pincushion cactus (*Mammillaria wrightii*), Galisteo sand verbena (*Abronia bigelovii*), and Knight's milkvetch (*Astragalus knightii*).

Santa Fe milkvetch may be present with black grama grass dominating. Dune unicorn plant is not likely to occur this far north (Patricia Barlow, botanist, pers. comm. 1994).

A plant survey for species listed on federal and state lists was conducted during

September 1993. This survey included category 2 species because under NPS policy category 2 species are given the same protection as listed species. Of the 14 species known to occur in Bernalillo County, no species were found in the monument. Two cacti species were determined to have the potential to occur in the monument. These were *Pediocactus papyracanthus* (common name grama grass cactus) and *Mammillaria wrightii*, another cactus.

The grama grass cactus is threatened by collection and habitat modification, including grazing activity and trampling. The *Mammillaria wrightii* cactus is protected by state law from unauthorized collection. This species has a wide sporadic distribution and may be in decline due to over-collection and habitat alteration.

REGIONAL AND MONUMENT USE

REGIONAL LAND USE AND REGIONAL VISITOR FACILITIES AND SERVICES

Petroglyph National Monument is bordered by residential developments on the east and northeast and the Double Eagle II Airport (general aviation) on the west.

On the south lies a large tract of undeveloped commercial/residential land. On the north is undeveloped land and a platted subdivision. It is likely that in the future the monument will be completely surrounded by urban development.

SOCIOECONOMIC ENVIRONMENT

County and Regional Characteristics — Overview

Albuquerque has a culturally diverse population. Native Americans make up about 3% of the population, and their culture continues to influence modern Albuquerque (as well as the rest of the nation), especially in the areas of fine art and crafts. The Hispanic community comprises about 40% of the area's population. This culture heavily influences the total community in many areas, including architecture, arts, food, and language. Other minorities add to the depth and breadth of the region's cultural diversity.

Albuquerque offers numerous and eclectic cultural activities — from traditional festivals to major sporting events. One of the largest events in the state is the annual Kodak-Albuquerque International Balloon Fiesta that is one of the largest air shows in the world. Albuquerque hosts several arts and crafts fairs as well as the New Mexico State Fair. The metropolitan area

supports a variety of professional dance, music, and theater groups as well as minor league baseball and professional soccer. The city is home to the University of New Mexico. With an enrollment of nearly 25,000, this institution provides a diverse selection of educational and cultural opportunities.

Population

The 1990 census figures place New Mexico's population at 1,519,724. This is an increase of 16.7% over the 1980 figure. Albuquerque is the state's largest city and the 38th largest city in the country. The Albuquerque Metropolitan Area, which includes Bernalillo, Sandoval, and Valencia counties, accounts for 39% of New Mexico's population (see following table). Population growth in the Albuquerque Metropolitan area is highlighted by the growth of the city of Rio Rancho, just north of Albuquerque in Sandoval County, which has more than tripled its population from 1980 to 1990 — from 9,985 to 32,505 (Consensus Planning, Inc. and Cole & Associates 1994). It has been one of the fastest growing communities in the nation.

Economy

Albuquerque's economy is maintaining a pace of slow but steady growth. Non-agricultural employment increased about 2.6% in 1990. This closely matched the performance of the previous years. The area supports a diversified economy including 18 major employers of more than 500 people. The exception to the city's steady growth is the rapid growth of the West Side of Albuquerque and Rio Rancho. Fueled by the development and

TABLE 10. POPULATION AND POPULATION PROJECTIONS

Year	Bernalillo County	Sandoval County	Valencia County	Albuquerque Metro Area	New Mexico
1980	419,700	34,799	30,769	485,268	1,302,894
1990	482,125	63,803	45,479	591,407	1,519,724
1995	518,532	76,719	51,689	646,940	1,643,580
2000	553,500	90,023	58,296	701,819	1,763,742
2005	583,966	104,845	64,946	753,757	1,880,103
2010	612,726	120,852	71,849	805,427	1,996,688
2015	642,709	137,561	79,246	859,516	2,115,878
2020	671,401	154,987	87,125	913,513	2,234,194

SOURCES: Bureau of the Census; Bureau of Business and Economic Research, University of New Mexico.

expansion of Intel Corporation in Rio Rancho, Albuquerque's West Side and Rio Rancho have experienced the rapid development of single-family homes. In January 1994 the West Side represented nearly two-thirds of all building permits issued in the city.

Transportation/Access

Albuquerque and Bernalillo County are served by air, road, and rail transportation systems.

Aviation. The city owns and operates Albuquerque International Airport. The 1,550-acre site is 15 minutes southeast of the central business district and has easy access to the interstate highway system. Eight air carriers provide direct passenger service to 45 cities. More than 100 departures occur daily. In 1989 passenger service was over 4.5 million, and growth is expected to be about 7% per year. Air freight service is provided by 11 carriers. The runways are owned by the city and, by agreement, used by Kirtland Air Force

Base. The airfield is capable of handling all types of commercial and military aircraft.

Albuquerque also owns and operates Double Eagle II Airport, a general aviation "reliever," which is due west of the monument. Fixed-base operations were established in 1988. Current flight operations are approximately 37,000 per year and are expected to increase. This airport can accommodate freight operations and aircraft maintenance work.

Coronado Airport is a privately owned facility that is open to the public. Annual flight operations are more than 129,000. This 254-acre facility is adjacent to I-25 and 15 minutes northeast of the central business district.

Highways. Albuquerque has an extensive system of primary and secondary roads. Interstate 25, running north-south, and Interstate 40, running east-west, intersect in the center of town. The area is connected to the entire country by this system of highways.

Freight and passenger traffic are constantly on the move throughout the city and county. More than 40 motor freight carriers operate in the area, providing access to all national markets. The city owns and operates the Sun Tran bus system. There are more than 30 routes serving all parts of the city.

Interstate bus service is provided by Greyhound-Traillways Bus Lines.

Railroads. The Santa Fe Railway provides mainline daily freight service connecting Albuquerque to all regions of the country. Amtrak provides daily passenger service to Los Angeles and Chicago.

Visitor Services

A full range of visitor services are available in the Albuquerque area. Hotels and motels are numerous. The Albuquerque Convention Center attracts large numbers of visitors year-round. Cultural activities include ballet, opera, symphony orchestra, and live theater. Albuquerque has many fine museums. An introduction to American Indian culture in New Mexico is available at the Indian Pueblo Cultural Center. This cultural attraction/museum is owned and operated collectively by the 19 Pueblo tribes in New Mexico. Shopping opportunities are abundant. The area also has numerous hospitals and related medical facilities.

Recreational opportunities are numerous and varied in the Albuquerque area. Ballooning, camping, golf, hiking, bicycling (touring and mountain), horseback riding, rafting, and snow skiing are a few of the readily available activities. The city offers an outstanding system of city parks; swimming and tennis are two of the popular activities available to the public. The city has one of the largest open space systems in the country, with 22,000 acres

of designated open space in the Sandia foothills, Bosque, and along the west mesa.

The city has developed an extensive trail system, comprised of routes on separate rights-of-way and on existing streets, to link various neighborhoods of the city (see Existing and Proposed City Trails map and appendix E for relevant related plans). This trail system provides for commuter and recreational use and connects with the city's extensive open space areas, including the Sandia Mountains, the Rio Grande Bosque, and the west mesa.

Cibola National Forest includes a designated wilderness and provides picnic facilities, a ski area, a snow play area, and many miles of hiking and mountain biking trails.

VISITOR USE STATISTICS AND ANALYSIS

Visitor use (as registered by an inductive loop traffic counter) is reported for Boca Negra Canyon area, which has the most use. Actual numbers of visitors participating in guided tours of Rinconada, Piedras Marcadas, and Mesa Prieta Canyons are also reported. This use amounts to about 9.4% of all recreation visits. At this time, informal use of other areas of the monument is not reported. Therefore, the reported visitation of the monument is less than what is actually occurring.

Reported use of the monument amounted to 48,403 visits in 1990 and 88,059 visits in 1994 (figure A). Relatively, visitor use was lower in January, February, November, and December for both years. October was the busiest month in 1990 and 1994.

Some visitation data are available for the Boca Negra unit of Petroglyph National Monument before June 1990 when this portion of the monument was operated as

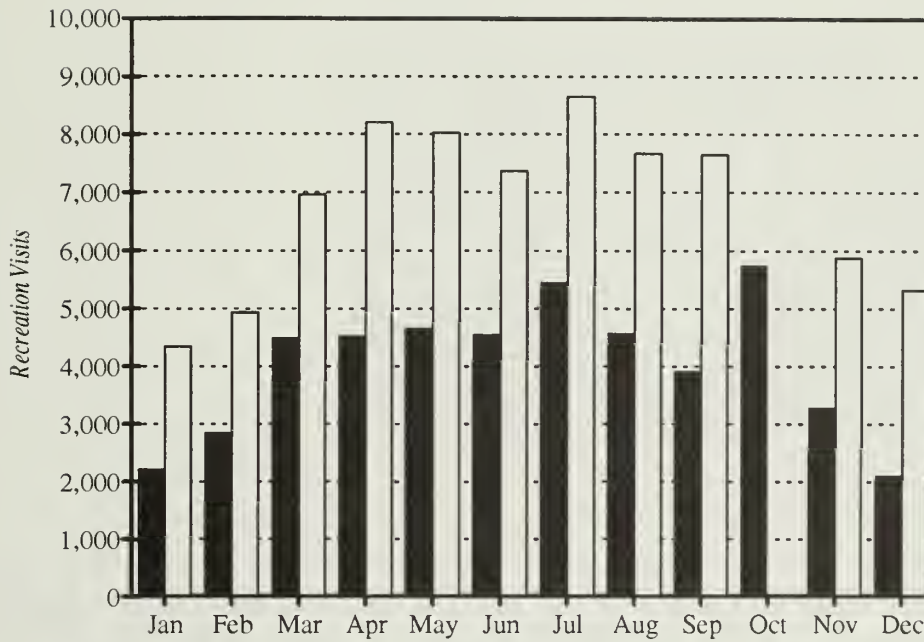


FIGURE A. VISITOR USE OF BOCA NEGRA CANYON BY MONTH FOR 1990 AND 1994

SOURCE: National Park Service, Washington Office, Socioeconomic Studies Division

Indian Petroglyph State Park. Visitation data for this area for 1985 through 1994 are shown in the following table.

Based on these figures, annual visitation for this area has increased more than fourfold since 1985.

**TABLE 11. MONTHLY VISITOR USE DATA FOR INDIAN PETROGLYPH STATE PARK
(BOCA NEGRA UNIT OF PETROGLYPH NATIONAL MONUMENT) —
1985 THROUGH 1993**

Month	Number of Visitors						
	1985	1988	1990	1991	1992	1993	1994
January	941	2,120	2,220	2,188	2,710	3,713	4,346
February	893	2,753	2,853	3,288	3,863	3,501	4,940
March	1,868	3,573	4,508	4,738	5,793	6,764	6,962
April	1,844	3,018	4,518	4,483	6,767	9,179	8,204
May	2,012	3,523	4,660	5,273	7,206	9,329	8,030
June	na	3,060	4,563	5,240	6,283	5,323	7,365
July	1,848	3,790	5,455	6,083	7,038	5,160	8,650
August	2,025	3,448	4,575	6,668	7,170	5,280	7,675
September	1,556	3,125	3,908	4,808	6,207	5,186	7,651
October	2,732	4,655	5,740	4,808	7,994	6,413	10,023
November	1,708	2,570	3,290	3,719	4,469	3,444	5,885
December	1,356	2,217	2,113	2,925	2,648	3,053	5,328
TOTAL	18,783 *	37,852	48,403	58,262	68,148	66,345	88,059

SOURCE: City of Albuquerque, Open Space Division, and Petroglyph National Monument

NOTE: The decrease in visitation in summer 1993 was due to the Hantavirus news stories.

* Indian Petroglyph State Park Became the Boca Negra Unit of Petroglyph National Monument in July of 1990. Vehicle counts were multiplied by 2.5 persons per vehicle each month to arrive at the figures presented here.

na = Not available, but during June 1984, 1,744 people were reported to have visited the state park.

ENVIRONMENTAL CONSEQUENCES



Rinconada Canyon looking northwest



Boca Negra arroyo after summer thunderstorm



Santa Fe Village

INTRODUCTION

THE DERIVATION OF IMPACT TOPICS

To compare the alternatives and focus the discussion of potential consequences of implementing the alternatives, specific impact topics were selected based on (1) federal laws, regulations, and executive orders, (2) NPS management policies, (3) knowledge of the resources, (4) resource studies, and (5) concerns expressed by the public, including special interest groups, the Pueblos, and other agencies, including the city and state, during scoping (see the "Consultation and Coordination" section for further discussion of scoping). A brief rationale for the selection of each impact topic is given below.

The cultural resource impacts have been divided into three sections — petroglyphs, the cultural landscape, and archeological sites — only to help organize the impact discussion. By definition, petroglyphs are archeological sites, and individual boulders containing petroglyphs are part of the larger archeological site. Archeological features such as grinding areas are often found near the petroglyphs. In turn, the combination of natural and cultural features (including the petroglyphs) and the meaning they possess for American Indians and land grant heirs make up the monument's cultural landscape.

Petroglyphs The national monument was established specifically to protect this irreplaceable resource.

Cultural Landscape The cultural landscape includes both natural and cultural features and provides the broad context within which these resources can be understood. The development and use of the monument could affect this broad context.

Archeological Sites The National Historic Preservation Act and NPS planning and cultural resource guidelines call for the consideration and protection of historic properties in development proposals. As defined by the National Historic Preservation Act, the term historic properties refers to all cultural resources, including prehistoric archeological sites, cultural landscapes, and historic sites eligible for or listed on the National Register of Historic Places. The evaluation of potential impacts of proposed actions on historic properties is required, as is attention to the provisions of the Native American Graves Protection and Repatriation Act for sites where burials may be present.

Values Held by Culturally Affiliated Groups The Pueblo Indians and the heirs of the Atrisco land grant regard the monument as a sacred place. Use by these peoples could be affected by the development and visitor use of the monument.

Air Quality The Clean Air Act requires federal land managers to protect park air quality, and NPS management policies address the need to analyze air quality during planning. Petroglyph National Monument is designated as a class II area. Albuquerque is currently not in conformity for carbon monoxide according to the Environmental Protection Agency's new regulations. However, this status may soon be reviewed and changed to reflect three consecutive years without violation of these standards. Therefore, the impacts of increased visitor traffic and monument staff are analyzed.

Scenic Resources A fundamental park purpose, according to the NPS organic

act, is to conserve the scenery. The purpose and significance statements that were developed for the monument also recognize the value of the monument's long vistas, both from within and of the monument. Concerns about the views of the city from the mesa top were raised during scoping.

Threatened and Endangered Species

The Endangered Species Act requires an examination of the impacts on all federally listed threatened and endangered species. NPS policy also requires the examination of the impacts on state-listed threatened or endangered species and federal candidate species.

Natural Drainage Patterns and Features

The arid environment, storms, and the state and local regulations pertaining to stormwater drainage require the examination of impacts on natural drainage patterns and features.

Biological Diversity NPS management policies call for protecting the biological diversity within NPS areas. This issue was also raised during scoping.

Soils Soils are important resources because they support plant and wildlife habitat that exists in the national monument. Proposed development and visitor activity would affect soils.

Local Visitors and Adjacent Private

Property Owners This category includes four concerns that were raised during scoping — additional traffic from visitors on neighborhood streets adjacent to the monument, visitors engaging in monument activities close to private lands, changes in existing monument land uses (dog walking, bicycling, and horseback riding), and boundary adjustments.

National Visitors to Petroglyph

National Monument The proposed

action and alternatives would affect how visitors from beyond the Albuquerque area understand and appreciate monument resources.

Regional and Albuquerque Economy

National monuments have the potential to contribute to the local and regional economy in various ways, including employment, operational expenditures, and land acquisition. Public lands also can have secondary effects on adjacent lands that could affect land values, the nature of adjacent land development, and local plans. The regional economy could be affected by increased tourism, changes in land values, and the quality of life related to protecting the natural and cultural resources of the monument. The issue is how to measure, evaluate, and quantify these economic impacts.

Energy Consumption The National Environmental Policy Act requires a discussion of the energy requirements of the alternatives. This impact topic includes potential solar energy use.

Noise Levels Additional noise levels that would be generated during construction and operation within the monument are assessed.

CUMULATIVE IMPACTS OF UNSER EXTENSION, RECREATION TRAIL, AND UTILITY CORRIDOR

The extension of Unser Boulevard and the modifications to the existing disturbed area within Boca Negra Canyon by the city for the recreation trail and utility corridor are consistent with NPS policies and this plan. Therefore, the general cumulative impacts of these actions are addressed in the appropriate impact sections.

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

The following explains the rationale for dismissing specific topics from further consideration.

Impacts on Floodplains Executive Order 11988 requires an examination of the impacts on floodplains and of potential risks involved with placing facilities within floodplains. No floodplains within the monument would be adversely impacted by development. All development has been sited to avoid the 100-year floodplain. In accordance with NPS regulations, all hazardous materials (such as found in maintenance areas) and cultural resource collections, including artifacts, would be stored outside the 500-year floodplain. The 500-year floodplain would be delineated during the design phase.

Impacts on Wetlands Executive Order 11990 and NPS management policies require an examination of the impacts on wetlands. Potential wetlands identified by the U.S. Fish and Wildlife Service are associated with the arroyos throughout the monument. These wetlands are intermittent streams that do not carry water most of the year but do carry water during storms. The national wetlands inventory maps indicate that although the maps identify these streams as wetlands, the assumption should not be made that they all qualify as wetlands. Additional fieldwork, including delineation of wetlands in areas proposed for development, would be completed during design, which would ensure that all development avoids adverse effects on wetlands.

Impacts on Prime and Unique Farmlands There are no prime and unique farmlands as defined by the U.S. Department of Agriculture within the

monument boundary; thus there would be no impacts on these lands.

Paseo del Norte The National Park Service has determined that there is no monument purpose for constructing Paseo del Norte. Therefore, according to the laws that apply to units of the national park system, there is no authority to allow Paseo del Norte to be constructed through the monument. Therefore, the presence or absence of Paseo del Norte is not being analyzed in this *General Management Plan / Development Concept Plan / Environmental Impact Statement*.

Existing City Plans The proposed action and alternatives do not affect the city's existing approved plans. The city's plans were affected by the congressional action designating this area as a national monument in June 1990 and the signing of the binding agreement in 1991. Congressional actions are not subject to the National Environmental Policy Act. Therefore, the impacts of the designation of the monument on the city's plans are not evaluated in this management plan / environmental impact statement.

NEPA AND SECTION 106 GUIDANCE FOR ANALYZING IMPACTS ON CULTURAL RESOURCES

Impacts on cultural resources from actions recommended in this management plan and by other outside influences are analyzed according to the National Environmental Policy Act. Additionally, section 106 of the National Historic Preservation Act requires agencies to consider the effects of their actions on historic properties. Regulations contained in 36 CFR 800 issued by the Advisory Council on Historic Preservation (ACHP) direct this evaluation process for federal agencies. Guidance is also provided by the

1990 servicewide programmatic agreement among the National Park Service, the National Conference of State Historic Preservation Officers, and the Advisory Council on Historic Preservation as well as *NPS Management Policies* and NPS 28, *Cultural Resource Management Guidelines*.

To comply with sections 106 and 110 of the National Historic Preservation Act, cultural resources are inventoried and evaluated to identify historic properties on or eligible for the national register. Following the identification of properties either on the register or that have potential to be on the register, the area of potential effect, in this case the entire monument, is defined. All proposed actions are analyzed in consultation with the state historic preservation officer and the Advisory Council on Historic Preservation to determine if historic properties will be affected.

If the National Park Service determines that there is no effect on historic properties, this decision is documented by the National Park Service (through completion of an assessment of effect form and notification of the state historic preservation office) and the project may proceed. If the proposed action is determined to have an effect on historic properties (and this effect may be beneficial), the project is further analyzed to determine whether or not it would have an adverse effect and require further 106 compliance actions.

According to section 106, an effect on a significant (eligible for the national register) cultural resource occurs if the undertaking (the proposed action) has the potential of changing in any way the characteristics that qualify that property for inclusion on the National Register of Historic Places. The entire area

encompassed within the monument was added to the National Register of Historic Places in 1990 through the passage of the monument legislation by Congress. Separate national register nominations had been prepared previously for Boca Negra Cave, Piedras Marcadas Pueblo ruin, and Las Imágenes Archeological District (Albuquerque west mesa escarpment). Section 106 also requires consultation with American Indians.

The National Environmental Policy Act directs agencies to analyze the direct, indirect, and cumulative impacts of their actions on resources, including cultural resources. Where such impacts might occur, agencies are required to consult with the advisory council, the state historic preservation officer, and the American Indians. Direct impacts are those that are likely to occur from construction. Indirect impacts are those likely to occur over time, during the operation of the monument facilities, such as vandalism, excavation of sites outside the monument, and illegal relic collection. Cumulative impacts are impacts from the proposed actions combined with impacts from actions proposed by others on resources in and outside of the monument.

In accordance with the National Environmental Policy Act, the analysis below discusses the direct, indirect, and cumulative impacts on resources in the national monument from proposed actions in the alternatives. In accordance with section 106 and with procedures established under the programmatic agreement, tables 12, 16, 18, and 20 list the monument's prehistoric and historic properties, the effect upon those properties, the proposed determination of effect, proposed mitigating measures, and further section 106 compliance required.

IMPACTS COMMON TO ALL ALTERNATIVES

The following section, as required by the National Environmental Policy Act, describes the impacts of implementing the four alternatives. Impacts common to all alternatives are described first. Cumulative impacts are described only for topics where there are cumulative impacts.

IMPACTS ON PETROGLYPHS, ARCHEOLOGICAL SITES, AND THE CULTURAL LANDSCAPE

There would be no direct adverse effects on petroglyphs. Under no circumstances would boulders with petroglyphs be moved.

Appropriate siting and design (with compatible materials) of facilities and trails would

- reduce the impacts of development
- minimize visual impacts on petroglyphs and their context and on the cultural landscape and maintain those characteristics that make these resources significant
- avoid direct negative impacts on most archeological sites; however, as outlined in the 1990 programmatic agreement, the Advisory Council on Historic Preservation, the state historic preservation officer, and concerned Pueblo Indians would be invited to participate in the design and construction process to ensure resource protection. If it were impossible to avoid sites, further mitigative measures would be developed before final design, in consultation with the state historic preservation officer, the advisory council, and concerned Pueblo Indians. These measures would be implemented before design and before undertaking any ground-disturbing activities.

Provisions for protecting previously unknown sites encountered during construction, including stipulations required by the Native American Graves Protection and Repatriation Act, would be included in construction documents. All construction would be monitored.

Constructing new trails and rehabilitating existing trails would generally have a positive effect on cultural resources by directing visitor use.

NPS experience in other areas has shown that by establishing an increased presence, directing and controlling visitor use, and providing an experience that allows visitors access but prevents actual contact with petroglyphs provides better protection than uncontrolled use. However, focusing visitor use in areas that previously had no visitor facilities could potentially result in some increased damage to cultural resources.

Having frequent patrols, establishing an increased presence, controlling visitor use, enforcing regulations, enhancing visitor education, and educating schoolchildren and other groups would

- provide better protection for petroglyphs, archeological sites, and the cultural landscape
- educate all visitors about the significance of the resources and stress the importance of preservation, which would provide better protection for petroglyphs, archeological sites, and the cultural landscape
- help prevent illegal collection activities, the trampling of sites, and the creation of social trails
- help minimize indirect impacts on archeological sites and petroglyphs that

might occur from concentrated visitor use in some areas

The identification and evaluation of cultural resources would help prevent negative direct or indirect impacts on archeological sites and the cultural landscape.

Monitoring resource conditions and responding to potential threats, along with the development of designated trails and visitor facilities, would

- minimize adverse impacts on petroglyphs from increased visitation
- minimize most of the potential impacts that could over time gradually diminish the integrity and scientific value of the petroglyphs, archeological sites, cultural landscape, and resources traditionally gathered by Pueblo or land grant heir groups

Constructing utility lines, access roads, and other supporting facilities for the various areas of development would have the potential to adversely affect archeological sites and the cultural landscape. No proposals have been submitted; proposed locations are not known.

During construction, dust, fumes from vehicles, noise, and large equipment would temporarily diminish the visual qualities of the cultural landscape and increase site-specific noise levels.

Accomplishing reclamation and revegetation work while avoiding disturbance to subsurface archeological sites or resources would reduce the potential for negative impacts.

A wide variety of sites, from Archaic lithic debris to Hispanic corrals and World War II bomb targets have been found on the mesa top, including the geologic windows.

The proper location of trails would help avoid these sites.

The effects of vibrations and material compaction from nearby construction activity on petroglyphs and archeological sites are unknown. Construction and material compaction techniques would be designed to avoid adverse impacts on petroglyphs and archeological sites.

Developing trails and viewing areas would have a positive effect upon the petroglyphs and their context by providing established viewing areas and by removing trails that wind through and between petroglyph concentrations or are too close to the features. Requiring visitors to stay on established trails and keeping trails at least arm's length back from petroglyphs, combined with regular ranger patrols, would have a positive impact on petroglyphs by decreasing the potential for visitors to touch the petroglyphs or scratch the rocks.

Localized pollution from buses and automobiles might have as yet undetermined effects on the patina into which the petroglyphs are carved. Potential adverse effects from pollution would be minimized by requiring buses to turn off their engines while parked. General urban air quality might also have a negative impact on the patina. Preparing the site and constructing buildings, roads, and trails could disturb or destroy surface and subsurface materials. The restoration of roads that are on archeological sites could result in additional disturbance. Potential adverse effects on archeological sites would be mitigated by data recovery and by having an archeologist present during ground-disturbing activities that might uncover archeological sites.

IMPACTS ON VALUES HELD BY CULTURALLY AFFILIATED GROUPS

Consultation on facility siting and design with the American Indian Pueblo community and the heirs of the Atrisco land grant would help ensure that new facilities, exhibits, and interpretive programs avoid areas of significance to these groups and would be compatible with the cultural landscape and traditional practices.

Special provisions outlined in the plan, such as temporary closures and the training of personnel, would provide privacy to conduct traditional activities and minimize negative impacts. Consultation with culturally affiliated groups would ensure that interpretive media and programs present a culturally sensitive and accurate picture of traditional values. Training monument staff in culturally sensitive interpretive messages would reduce negative impacts on cultures affiliated with the monument. Consulting with Pueblo Indians and heirs of the Atrisco land grant would help ensure the preservation and continuation of the resources traditionally gathered by these groups.

The reclamation or revegetation of informal trails or previous development would be preceded by consultation to identify the resources traditionally gathered by Pueblo Indians and heirs of the Atrisco land grant to ensure that there is no negative impact.

IMPACTS ON THREATENED AND ENDANGERED SPECIES

Eagles and whooping cranes (species on the federal list of threatened and

endangered species) migrating through the monument would not be affected. Black-footed ferrets, also listed on the federal list, historically occurred in Bernalillo County, but have not been seen in the county since the 1920s.

The millipede *Toltecolus chihuuanus*, a category 2 species (being considered for listing), would not be adversely affected by NPS actions under this alternative (University of New Mexico, Cliff Crawford, biologist, pers. comm. April 1994).

Fencing the monument would not present a barrier to wildlife.

There might be cumulative impacts on the *Toltecolus chihuuanus* resulting from the city's construction of Unser Boulevard across the escarpment. Site-specific surveys must be conducted before construction to ensure that no threatened or endangered species were present.

IMPACTS ON NATURAL DRAINAGE PATTERNS AND FEATURES

Stormwater management, which would prevent degradation of monument resources and ensure that natural drainage patterns and features, would be maintained. Cooperation by the Park Service, the city, and the Albuquerque Metropolitan Arroyo Flood Control Authority, would have positive impacts on monument drainage features, soils, vegetation, and wildlife.

IMPACTS OF IMPLEMENTING ALTERNATIVE 1 — PROPOSED ACTION

Note: When no cumulative impacts would occur for a specific topic, this heading has been deleted from the discussion.

IMPACTS ON CULTURAL RESOURCES

Methods for Analyzing Impacts on Cultural Resources

Areas proposed for development were inventoried to identify cultural resources. Most sites along the escarpment are included within the national register district or as part of a separate nomination and are considered contributing elements.

Some sites have not yet been evaluated for national register eligibility. However, for the purposes of this document, all potentially affected sites are treated as eligible. Maps showing the locations of petroglyph concentrations, cultural landscape resources, and archeological sites were compared with the development and visitor activity plans. The resulting information was incorporated into tables 12, 16, 18, and 20 and the following impact analysis. The effects of proposed alternatives on resources were assessed according to the advisory council's procedures (36 CFR 800.9), and preliminary conclusions regarding effects are included in the tables listed above. As more detailed site plans were prepared, further analysis and consultation would be conducted.

Cultural resource surveys of monument resources are continuing, and newly discovered sites would be evaluated for the national register as part of the inventory process. When specific information is available on proposed developments (but before final design and implementing actions that might affect potentially eligible resources), appropriate avoidance or

mitigating measures would be developed in consultation with the state historic preservation officer, concerned Pueblo Indians, and the Advisory Council on Historic Preservation.

Impact Analysis on Petroglyphs

The redesign of the trails and viewing areas at Boca Negra Canyon would have a positive effect upon the petroglyphs and their context by providing established viewing areas and by removing trails that wind through and between petroglyph concentrations or are too close to the features.

Locating facilities within the four main canyons would increase visitation in areas where little visitation has occurred, except in Boca Negra Canyon (the current primary visitor use area), which could result in some increased risk for vandalism or inadvertent damage to the petroglyphs.

The petroglyph research center would promote research regarding and public education and appreciation of the petroglyphs. Monument resource management and center staff would develop viable ways to conserve the petroglyphs and repair vandalism — all of which would help prevent adverse impacts on petroglyphs.

Impact Analysis on Archeological Sites

The proposed site for the heritage education center is in an archeologically sensitive area. In site design, every attempt would be made to avoid direct impacts on archeological resources. However, if archeological resources cannot be avoided, a new construction site would be

identified, in the same general area or elsewhere, through a site selection study. This study would be developed in concert with American Indians, Atrisco heirs, and the public. Potential impacts on sites from construction of an access road cannot be evaluated until routes are defined. Further archeological investigations would be conducted before the design phase to guide the placement of developments and minimize the impacts of development on these sites.

The construction of a parking area and an access road for trails near Mesa Prieta and proposed development in other areas (Lava Shadows and Rinconada, Boca Negra, and Piedras Marcadas Canyons, neighborhood access points, the volcanoes, 81st Street overlook, and mesa top) would be sited to avoid or minimize direct negative impacts on archeological sites (see following table).

Allowing horseback riding within the monument increases the risk of damage to cultural resources by horses straying off the trail and trampling sites. Negative impacts might also occur from bicyclists straying off the trail. Both activities create a churning effect that destroys soil strata and displaces and breaks artifacts. The designation of formal trails would focus horseback and bicycle riding activities and help protect archeological sites from illegal collecting and site disturbance. Frequent monitoring of areas along the trails, and implementing protective measures in areas where straying is apparent, would help reduce negative impacts on sites.

At the Piedras Marcadas Pueblo ruin, designing appropriate facilities, monitoring resources and visitor use during and after the development of visitor facilities, removing existing residential structures, and developing site protection measures would help prevent negative impacts on the archeological resources. The use of

noninvasive archeological techniques would avoid the destruction of archeological data and prevent the disturbance of areas held sacred by the Pueblo Indians.

Consulting with the Pueblo Indians, especially with regard to the Piedras Marcadas Pueblo ruin, would also increase participation and involvement in monument interpretation and resource protection programs, which would also help reduce impacts.

Reclaiming abandoned mine sites would have a slight potential to adversely impact unknown archeological resources.

Impact Analysis on the Cultural Landscape

Facilities would intrude on the cultural landscape and compromise its visual integrity, including those qualities of feeling, association, and setting that contribute to its potential national register properties. Designing and locating facilities to minimize visual intrusion on the cultural landscape and to maintain those characteristics that make it significant would reduce the adverse impacts of development. Such design would be especially important on the mesa near the volcanoes, at Mesa Prieta, and at Piedras Marcadas and Rinconada Canyons where unobstructed views of the Sandia Mountains and valley below are important.

The construction of trails, access road, and parking adjacent to the volcanoes, one of the major character-defining elements of the cultural landscape, would require special attention and consultation with the state historic preservation officer, the Advisory Council on Historic Preservation, and the Pueblos before and during construction to avoid impacts. The modification or removal of significant character-defining features identified in the cultural

landscape overview would be avoided to the extent possible and practical.

Existing developments at the volcanoes area contribute some noise and visual intrusion into the cultural landscape; proposed development would result in more visitor use and more intrusive noise and visual clutter from vehicles.

Developing a trail to the top of Black Volcano and prohibiting use on the other volcanoes would have a beneficial effect by eliminating use on the other volcanoes that are considered sensitive areas by the Pueblo peoples.

TABLE 12. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 1 ON CULTURAL RESOURCES LISTED ON OR ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES, PROPOSED PROTECTIVE MEASURES, AND REQUIRED COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT.

Note: The entire monument, Boca Negra Cave, Las Imagines Archeological District, and the Piedras Marcadas Pueblo ruin are all listed on the national register. Cultural resources include cultural landscape, archeological and

ethnographic sites, and petroglyphs. Unless otherwise noted in the following table, construction could probably avoid sites.

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Boca Negra Canyon — Six adjacent sites include 1 stone circle, (age unknown); 4 water and soil control structures; 1 historic shelter. Vicinity: petroglyphs, potential cultural landscape.	Construct visitor center, interim heritage education facility, parking, access roads, restrooms, trails.	• No adverse effect of construction. • Positive effect on petroglyphs by rebuilding inadequate trail system. • With mitigation, no adverse effect from visitor or student use.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor and student use. • Conduct archeological investigations, collect artifacts, and document and stabilize sites and surface features in areas adjacent to facilities and where intensive use is proposed.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.

TABLE 12. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 1 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Piedras Marcadas Canyon — Sites include three prehistoric lithic scatters (one Archaic); one lithic and ceramic scatter; four prehistoric sites with stone circles, water control features, and/or lithic/ceramic scatters; at least two multicomponent sites containing prehistoric lithic scatters, grinding slicks, and/or historic herding artifacts and features. Vicinity: petroglyphs, potential cultural landscape, ethnographic sites.	Construct visitor contact facility, parking, restrooms, access roads, trails.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use. • If resource damage were occurring, permits would be required.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Mesa Top at Northwest Part of Monument, near Piedras Marcadas Canyon — One site in area (prehistoric lithic and ceramic scatter, PIII-PIV). Potential cultural landscape, petroglyphs.	Construct parking, access road, trail.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	Same as above.

TABLE 12. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 1 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Piedras Marcadas Pueblo Ruin	Develop interpretive trail; remove existing building.	With mitigation, no adverse effect.	• Continued consultation with Pueblos. • Develop ruins management plan in consultation with Pueblo community, SHPO, and ACHP. • Collect, document, and stabilize to prevent erosion. • Develop mitigation plan with SHPO. • Design visitor facilities to avoid pueblo ruins or intrusion upon cultural landscape and to prevent impacts from visitor use. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitation. • Fence and patrol site.	SHPO/ACHP consultation in preparing preliminary design, mitigation plan, and ruins management plan.
Rinconada Canyon — Two multi-component sites with historic and prehistoric petroglyphs, masonry wall alignments and isolated room; rock shelters and/or post WWII homesite. Potential cultural landscape, ethnographic sites.	Build visitor contact facility, access road, parking, restrooms, trails, and connector trail to mesa top.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use. • If resource damage were occurring, permits would be required. • Conduct archeological investigations, collect artifacts, and document and stabilize sites and surface features in areas adjacent to facilities and where intensive use is proposed.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.

TABLE 12. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 1 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Mesa Prieta — Adjacent archeological sites: two multicomponent (prehistoric and historic) sites with remains of prehistoric lithic procurement/reduction, stone alignments, and/or petroglyphs; historic remains and military and/or other activity areas. Potential cultural landscape and petroglyphs.	Build heritage education center, if needed, and parking, access roads, trails, and picnic area.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage.) • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor and student use. • Conduct archeological investigations, collect artifacts, and document and stabilize sites and surface features in areas adjacent to facilities and where intensive use is proposed. • If archeological sites cannot be avoided, a new site would be selected through a site selection study.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Southern Mesa Prieta — Seven prehistoric sites (lithic quarry and reduction/scatters, activity areas, boulder features); 1 historic site (corral and artifact scatters); and 4 multicomponent sites with historic activity areas, corrals, and/or artifact scatters; prehistoric component has lithic quarry/reduction scatters, ceramics, water catchment/rock features, agricultural fields, and/or hearths/fire cracked rock. Adjacent are petroglyphs, potential cultural landscape, ethnographic sites and historic livestock drive route. At least 12 sites in area.	Build overlook, parking, access road, and trails.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	Same as above.

TABLE 12. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 1 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
South of Boca Negra Canyon — One adjacent site, prehistoric lithic scatter. Vicinity: petroglyphs, potential cultural landscape, ethnographic sites.	• Build petroglyph research center, access road, parking (perhaps combined with administrative complex below). • Improve existing road, construct parking and administrative facility, and trail access to mesa top. • Raze existing structures.	With mitigation, no adverse effect.	• Presence of research center would help deter vandalism and resource degradation. • Design facilities to avoid cultural sites or intrusion on cultural landscape. • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Include in monitoring and response plan.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Lava Shadows — One adjacent site (water control/rock alignments, cairns). Vicinity: petroglyphs, potential cultural landscape, ethnographic sites.	Raze existing structures, build parking and trailhead.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	Same as above.

TABLE 12. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 1 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 10e Compliance Requirements
Volcanoes — Volcanoes are sensitive ethnographic resources; four prehistoric sites nearby include petroglyphs, rock shelter, lithic/ceramic scatters, and/or grinding stone; three historic sites include corrals, pre- and post-WWII historic debris, lambing pens, hearth and/or corral; 1 site has corral and lambing pen, rock shelter and lithic/ceramic scatters. Vicinity: potential cultural landscape, ethnographic sites.	• Construct parking, access road, visitor information kiosk/shade structure, restrooms, trails, picnic facilities, and overlook on Black Volcano. • Reclaim cinder mining sites. • Revegetate selected trails and roads.	With mitigation, no adverse effects from construction, reclamation, or visitor use. Area has been impacted. Limiting public access to other volcanoes would be beneficial to values held by culturally affiliated groups. Cinder mines would not be reclaimed if adverse impacts on values of these groups would occur.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use. • Conduct archeological investigations, collect artifacts, and document and stabilize sites and surface features in areas adjacent to facilities and where intensive use is proposed. • When rehabilitating facilities and cinder mines, use care to avoid disturbance of unknown subsurface remains. • Consult with American Indians to ensure that traditionally gathered resources are not disturbed. • Document cinder mines before reclamation.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Geologic Windows — 13 sites in vicinity of proposed trails (prehistoric petroglyphs and rock features, windbreak; historic corrals, structures, shelter, and walls). Potential cultural landscape.	No action.	No adverse effect.	• Continued consultation with Pueblos. • Establish monitoring and response plan.	None.

TABLE 12. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 1 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
81st Street Overlook — One prehistoric site with structural wall, lithic scatter. Vicinity: potential cultural landscape, ethnographic sites.	Construct parking, access road, overlook, and trails.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Mesa Top — Sites are too numerous to list, ranging from Archaic period to present. Potential cultural landscape.	Construct trails, revegetate selected existing roads and trails.	• With mitigation, no adverse effect. • If multiuse trails are built on mesa top, Pueblo values could be adversely impacted.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use. • Most trails would follow existing informal roads. • Permits would be required for horse and bicycle users.	Same as above.

TABLE 12. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 1 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Neighborhood Access — Several adjacent sites, including lithic/ceramic scatters. Vicinity: petroglyphs, potential cultural landscape	Construct neighborhood access points and trails.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Escarpment Crossings, Boca Negra, Calle Norteña, Lava Shadows — Four sites in vicinity: one prehistoric lithic reduction site (Calle Norteña); prehistoric shelter; Anasazi water and soil control walls and terraces (Boca Negra).	Build multiuse trails crossing escarpment.	With mitigation, no adverse effect.	• Sites would be avoided. • Design escarpment crossing trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage).	None unless resources were found.
Homestead Circle, Taylor Ranch Road/Calle Norteña Area — One prehistoric site (lithic/ceramic scatter) in vicinity	• Add fill and develop paths, shade structures, native plantings, wall at Homestead Circle • Recontour and revegetate disturbed area adjacent to Calle Norteña and Taylor Ranch Road	With mitigation, no adverse effect.	No known resources in proposed development areas. Site-specific surveys would be conducted as appropriate before development.	SHPO/ACHP review of project if resources are discovered.

Conclusion of Impacts on Cultural Resources

The identification and evaluation of resources, sensitive design, and appropriate mitigating measures would help ensure that archeological sites would not be negatively impacted during and after facility development. Directing use as

recommended in this alternative would have less impact on petroglyphs than the existing uncontrolled visitor use. Trail redesign and development would have a beneficial effect on petroglyphs. The management of visitors as described would reduce the potential for negative indirect impacts of concentrated use in selected areas and damage from looting

and vandalism. With continued consultation, direct or indirect negative impacts on ethnographic resources or Pueblo values would be minimized. Visitor facilities would intrude on the cultural landscape, but sensitive design would minimize negative impacts.

Cumulative Impacts on Cultural Resources

Vandalism, illegal artifact collecting, and inadvertent damage to petroglyphs and other archeological sites, both in and outside of the monument, damage these irreplaceable resources and destroy scientific evidence through the undocumented removal or disturbance of objects from their original locations. Potsherds and tools are diagnostic artifacts. Once they are removed from an undocumented site, it may be impossible to determine whether the site dates from 1,000 B.P. or 10,000 B.P., or even who used the site. Over time, these activities reduce the number and quality of sites and there would be a cumulative impact on the sites and on the data base, which can skew and limit the information available for research. Various efforts and programs would be focused on preventing these adverse impacts; however, some impacts would occur.

The impacts of development are mitigated by collecting data, but this is done by 1990s standards. Twenty years ago most of the analytic techniques and technology used today were not imagined. The same will be true 20 or 50 years from now. Once a site is disturbed, there would be no opportunity to do more analysis. Therefore, over time and with development, visitor use and maintenance activities, erosion, etc., some diagnostic artifacts and features would not be preserved for future analytic techniques that would reveal even more about the site than can be learned at present.

The development adjacent to the monument has negatively affected the visual qualities of the landscape and will continue to do so. Monument facility development combined with the adjacent development would adversely affect the cultural landscape.

There would be impacts on cultural resources by the city's construction and use of Unser Boulevard through the escarpment and possibly by the removal of the existing road and the construction of the recreational trail and utility corridor through Boca Negra Canyon. These impacts would be mitigated by minimizing the rights-of-way and disturbed areas required for the routes, using construction techniques that would not disturb adjacent basalt and petroglyphs, and using design and materials to minimize noise and visual intrusion.

IMPACTS ON VALUES HELD BY CULTURALLY AFFILIATED GROUPS

Methods of Analyzing Impacts

The planning team has involved, consulted, and informed the Pueblo Indian communities of the planning process and issues that could affect lands that are significant to them. The initial step was to conduct a rapid ethnographic assessment (Evans et al. 1993) to determine which American Indian groups wanted to be involved with the monument planning process, what their concerns were about monument planning, and what would be the best way for them to participate. Based on the results of the ethnographic assessment, American Indian representatives were invited to participate in core team meetings.

In addition to the rapid ethnographic assessment, planning team members have met with Pueblo and Atrisco heir

representatives, ethnographers, and others in an effort to better understand the impacts on culturally affiliated groups.

Impact Analysis

Developing Piedras Marcadas Pueblo ruin only after special study and consultation with concerned Pueblos would avoid impacts related to intrusion on sacred and significant areas and human remains and artifacts. Consultation would result in further participation and involvement by culturally affiliated groups in monument interpretive and resource protection programs.

If reclaiming abandoned mine sites would adversely impact areas of spiritual significance to the Pueblo community, reclamation would not occur in that specific area.

Conclusion

There might be positive impacts on the values held by these groups through participation in consultation regarding site protection and interpretation and by limiting public access to the volcanoes. There would be adverse impacts from the intrusion of bicycles and horses into lands that are important to the Pueblo community. Impacts from development and increased visitation on religious activities are currently unknown.

Cumulative Impacts

If petroglyphs or archeological sites, features, or objects were destroyed or desecrated by vandals, or if practitioners were disturbed by construction or the presence of visitors and they were not able to use a special area for traditional

religious activities, that ritual might not be continued.

The construction of Unser Boulevard by the city through the monument escarpment is opposed by American Indian groups and the Atrisco heirs. There would be adverse impacts on these groups and their ability to maintain their connections to the monument.

IMPACTS ON FEDERAL AND STATE THREATENED AND ENDANGERED SPECIES

Methods for Analyzing Impacts

The impacts on threatened and endangered species were based on the likelihood of each species and its habitat type occurring in the proposed development and visitor use areas within the monument and direct loss of habitat based on total acreage within the monument. Consultation was conducted with the U.S. Fish and Wildlife Service, the National Biological Survey, and the state. Section 7 consultation would be conducted with the Fish and Wildlife Service.

A plant survey was conducted of all proposed development sites and major visitor activity areas except for the Mesa Prieta area and south of Rinconada Mesa. No plants were found that were either listed or candidates for listing as federal or state threatened and endangered species. The site survey concluded that potential habitat exists for the *Pediocactus papyracanthus*, commonly known as the grama grass cactus (a category 2 species being considered for listing), and the *Mammillaria wrightii* (a state rare plant). Surveys were not conducted for bird species; however, information was obtained from a local ornithologist who has conducted regular bird surveys on

monument lands since 1990 and has maintained detailed records.

Impact Analysis on Plants

The development of 15.6 miles of multiuse trails and 2 acres for parking, trailheads, and overlooks on the mesa top within the monument would disturb a total of about 35 acres. However, 20 acres of this has been previously disturbed by existing dirt roads and trails. Therefore, there would be adverse impacts on 15 acres of potential habitat for the *Pediocactus papyracanthus* and *Mammillaria wrightii*.

Bicycling and horseback riding could further impact habitat for these species indirectly because of the greater potential for off-trail use and trampling. Permits and the enforcement of regulations that visitors must stay on trails would prevent most adverse impacts associated with these activities.

Conclusion. There are potentially 4,534 acres of total potential habitat available; 15 acres represents .30% of the total available habitat. This would not be significant in terms of habitat available in the monument.

Cumulative Impacts. The destruction of further habitat could eliminate the opportunity for the *Pediocactus papyracanthus* and *Mammillaria wrightii* to populate this area and thus could incrementally contribute to the overall decline of the species. As more and more habitat is used for development outside the monument by the private sector, habitat within the monument would become more valuable.

It is not anticipated that there would be any adverse impacts on threatened or endangered plant species by the city's construction/extension of Unser Boulevard

or the development of the recreational trail and utility corridor in Boca Negra Canyon because these routes are in areas that have been previously disturbed. Site-specific surveys must be conducted before construction to ensure that no threatened or endangered species were present.

Impact Analysis on Birds

Without mitigation, the multiuse trails with horseback and bicycle riders on the mesa top and the parking areas at Mesa Prieta and the volcanoes would have a direct adverse effect on the ferruginous hawk (a federal category 2 species). Trail users would adversely affect the birds' ability to hunt throughout the monument during certain parts of the day as well as disrupt any nesting activity.

These birds are very sensitive to human disturbance. Unlike many other bird species that tolerate human activity near their nest sites, the ferruginous hawk has been known to abandon its eggs and at times its young when disturbed by humans near nest sites. One study found that incubating ferruginous hawks did not habituate to experimental disturbances; rather, they became sensitized and flushed at increasing distances each time they were disturbed. This same study concluded that ferruginous hawk presence may be more an indicator of the level of human disturbances than of habitat quality in the ecological sense (White and Thurow 1985).

The ferruginous hawk has been known to nest on the ground, but other areas also provide suitable habitat for nesting activity. (One possible nest has been identified in the monument.) Based on information available, the construction and use of multiuse trails in the monument would have significant adverse effects on the ferruginous hawk and eliminate them as a breeding species in this area.

The construction of a heritage education facility near the water tank, south of Rinconada Mesa, would not adversely affect the ferruginous hawk. However, groups hiking during the critical nesting period (March 1–July 1) might adversely impact nesting activity, causing the birds to abandon their nests and young.

The National Park Service would work with the U.S. Fish and Wildlife Service, National Biological Survey, and local ornithologists to develop mitigation to protect the hawk and avoid a significant adverse effect. This might result in areas of the monument being closed during certain times of the year to allow nesting to occur and prevent disturbance until young are hatched.

Conclusion. Without mitigation, the ferruginous hawk would be significantly adversely affected by the development and use on the mesa top. Because the hawks have been known to nest on the ground and use the monument for hunting, mesa-top trails would eliminate any safe areas where they could be ensured of little to no contact with human activity. Pedestrians on trails below the escarpment at certain areas might adversely affect the hawks during the nesting period (March 1–July 1); however, activity at other times would not be expected to adversely affect this species. Initial mitigation would include avoiding the construction of trails above and below the escarpment during the nesting period.

Also, the heritage education center would not be constructed during the nesting period to ensure that disturbance would not occur. Other mitigation measures developed with the U.S. Fish and Wildlife Service, the National Biological Survey, and local ornithologists would avoid significant adverse impacts.

Cumulative Impacts. According to records, ferruginous hawks were probably more numerous in central New Mexico than they are currently. However, the conversion of grasslands to urban and agricultural uses has contributed to the hawk's decline. Without mitigation, facility development under this alternative, combined with the development of lands outside the monument by the private sector and Unser Boulevard by the city could incrementally increase the amount and severity of the impacts on this species and could contribute to the elimination of the hawk as a breeding species in this area. With mitigation, there would be no significant adverse cumulative impacts on the hawk.

IMPACTS ON WILDLIFE OTHER THAN LISTED SPECIES

Methods for Analyzing Impacts

Existing studies were consulted to determine the extent and type of wildlife in the monument. No new surveys were conducted; however, recent bird surveys were used, wildlife habitat was identified, and acres affected by development and visitor activity were calculated to determine impact.

The total acreage of wildlife habitat within the monument is 7,244 acres. The acreage distribution is as follows:

	<u>Acreage</u>	<u>% of Total Monument Acreage</u>
Flat lands	1,475	20
Escarpment edge	35	<.5
Mesa top	4,534	63
Escarpment	<u>1,200</u>	17
Total	7,244 acres	

Most impacts on wildlife habitat from development and visitor activity would

occur in 16 acres of flat lands below the escarpment. This represents 1% of the total available in the monument. About 3.5 acres of escarpment edge would be impacted by visitor activity — representing about 1% of the total within the monument. Also, 35 acres of mesa top would be impacted by development, representing 0.70% of the total available within the monument. However, 20 acres of this has been previously disturbed by existing dirt roads, trails, and parking spots. Therefore, adverse impacts would occur on 15 acres of mesa-top habitat representing 0.3% of the total available within the monument. About 0.75 acre of the escarpment would be adversely impacted by trails and represents less than 0.1% of the total within the monument. These impacts would not be significant.

Impact Analysis on Birds

A total of 106 bird species have been recorded at the monument since 1990, 35 of which have also been seen nesting in or near the monument boundary. The diversity of species present is evidence of a relatively healthy ecosystem (Hart Schwarz, local ornithologist, pers comm., January 1994). As land adjacent to the monument continues to be developed and vacant land is eliminated, the monument will become an island of natural habitat for wildlife. Populations might be displaced onto monument lands and compete for habitat with existing residents.

Except as discussed above for the ferruginous hawk, no other raptors would be impacted by visitors because trails would be constructed far enough from the edge to prevent visitors from disturbing nesting birds. Overlook sites would be placed in areas that avoid any raptor nesting sites, including a golden eagle nest (although apparently abandoned for several years). The temporary closure of these overlooks

and trails would prevent adverse impacts on nesting raptors who might, during some years, place their nests near the overlooks.

Temporary direct adverse impacts on these birds would be avoided during construction by limiting construction periods to times when the birds are not nesting (March to August). Horse, bicycle, and pedestrian use and presence on the mesa top might discourage raptors from hunting in this area. Monitoring would be conducted, and visitor carrying capacity levels would be identified to prevent significant impacts from visitors.

The development under this alternative would adversely affect 13.5 acres of shrub/grassland (flat land), which is habitat for the loggerhead shrike. This represents 1% of the total available habitat within the monument and would not represent a significant impact on this species. Increased activity in visitor use areas might indirectly impact the birds, causing disturbance and adversely affecting their ability to nest; however, no studies have been conducted to confirm this.

Temporary adverse impacts would occur during construction. The construction of a new administrative facility and maintenance area south of Boca Negra Canyon would not adversely affect habitat for the shrike because the site currently has an 1,800-square-foot office building and is already disturbed. This site was chosen to avoid affecting a previously undeveloped area.

The crissal thrasher and sage sparrow occupy the same habitat as the loggerhead shrike. Adverse effects on shrikes would also occur on the crissal thrasher and sage sparrow.

Impact Analysis on Other Wildlife

No specific parts of the monument are known to support unusual or large populations of wildlife — with the exception of Mesa Prieta, which supports nesting habitat for raptors.

According to biologists, the flat lands in the base of the canyons and the edge area adjacent to the escarpment most likely support more wildlife species than found on the mesa top or on the escarpment itself. Assuming that the flat lands and edge of the escarpment are habitat areas, the construction of facilities and trails would impact about 20 acres of monument wildlife habitat. This represents 1% of the total flat lands habitat available in the monument.

Constructing multiuse trails, pedestrian only trails, parking, and overlooks on the mesa top would disturb 35 acres. However, 20 acres of this has been previously disturbed by existing dirt roads, trails and parking areas. There would be a loss of 15 acres of mesa-top habitat, representing .3% of mesa-top habitat available in the monument.

The 15.6 miles of horse/bicycle/pedestrian trails on the mesa top would likely increase the numbers of visitors who visit the mesa top. Some wildlife species tend to leave an area when it becomes populated by people, which would create less diversity of species on the mesa top. The presence of hikers, bicycles, and horses on the mesa top might disturb species and lead to a decrease in population due to loss of habitat or disturbance. Monitoring, issuing permits, identifying carrying capacity levels, and keeping visitors on established trails might mitigate some of these adverse impacts on wildlife species.

As more and more adjacent land is developed, there would be indirect adverse

impacts on wildlife. Habitat for many species such as rodents, rabbits, coyotes, and foxes would diminish, forcing many of them to compete for available habitat on monument lands. Wildlife populations adjacent to the monument would decrease due to loss of habitat.

Conclusion

No significant adverse impacts on birds and other wildlife would be anticipated from developing facilities on 20 acres and 25 miles (about 35 acres) of multiuse and pedestrian only trails within the national monument. Some wildlife populations would be adversely affected due to trails, people, horses, and bicycles on the mesa.

Cumulative Impacts

A total of about 55 acres of facility and trail development combined with adjacent development and city construction of Unser Boulevard would cumulatively impact birds and other wildlife species by destroying habitat and creating a barrier to movement by some wildlife.

IMPACTS ON NATURAL DRAINAGE PATTERNS AND FEATURES

Methods for Analyzing Impacts

A 1991 U.S. Geological Survey erosion study identified 50 gullies within the monument. These gullies were ranked according to four erosion classes — class I was defined as slight erosion (21 in the monument), class II as moderate erosion (22 in the monument), class III as intense erosion (6 in the monument), and class IV as severe erosion (1 in the monument). Fourteen of the gullies were associated with mesa-top dirt roads, 7 were on pedestrian or bicycle trails, 11 were

associated with a permanent stream channel, and 18 were on a hillslope.

The study noted a higher density of gullies in the northern areas of the monument, possibly related to the higher density of dirt and gravel roads and pedestrian and bicycle trails in the northern areas. Mesa-top roads appear to be channeling surface runoff, resulting in gullying and rilling in the roadbed. Thirty of the 50 gullies were identified with surface drainage from existing mesa-top dirt roads. Impacts of development and visitor activity, including trails with hardened surfaces, were evaluated using the results of this study.

Impact Analysis

Most rainwater on monument lands percolates into the ground through the sand and down through cracks and fissures in the basalt caprock. During large storms, the soils become saturated rather quickly, and the basalt caprock limits complete and fast percolation. Soils compacted by grazing activity also slow percolation. Both conditions lead to the channelization of water and the subsequent formation of gullies and erosion. Stormwater on the mesa top tends to flow as sheet runoff either into arroyos or over the top of the escarpment.

The hardening or compacting of about 55 acres for parking areas, trails, and facilities would increase sheet flow, the formation of gullies, the erosion of sediment, and cause flooding, which would adversely impact soils, vegetation, and possibly facilities. All development would comply with the intent of state and local stormwater regulations. Particular attention during the design phase would be made to minimize adverse impacts. Various stormwater management techniques, such as developing detention ponds (or holding areas), minimizing impervious areas,

revegetating disturbed areas, locating structures to minimize erosion, minimizing the disturbance of natural contours, and other innovative approaches, would be used in design to help minimize impacts.

Restoring and revegetating 20-30 miles (about 35 acres) of dirt roads and trails on the mesa top and about 15 acres of disturbed flat lands would decrease the number of gullies forming and minimize further erosion on the mesa top. Gullies would continue to enlarge or get smaller, depending on the amount of water and sediments they would carry during storms. Flooding during major storms would continue, creating new channels and erosion of the escarpment where water comes over. Providing designated trails for residents adjacent to the monument to access the mesa top would reduce further erosion of the escarpment edge.

Conclusion

The hardening of land for facilities and trails would increase surface runoff in the monument. The area of impervious surfaces would be about 55 acres. Establishing designated trails to gain access to the mesa top, and revegetating and restoring about 50 acres of disturbed lands would have a positive impact by eliminating existing gullies and helping to prevent further gullying and erosion. This represents an overall beneficial effect on vegetation and soils and the monument's capacity to handle stormwater.

Cumulative Impacts

The construction of monument facilities and, in addition, the development of adjacent properties and the construction of Unser Boulevard by the city would have impacts on natural drainage patterns and features. There would be adverse impacts

on natural drainage patterns within the new Unser Boulevard alignment. Positive impacts from extending Unser Boulevard would include the removal of a 1,000-foot trench that is outside the monument, which directs stormwater flows from Paradise Hills into Piedras Marcadas Canyon. Other positive impacts would be providing an opportunity to manage stormwater flows in a manner that would not adversely affect monument resources.

IMPACTS ON BIODIVERSITY

Methods for Analyzing Impacts

Information on the biodiversity of the west mesa was gathered from ecological studies and reports prepared before the creation of the national monument. It was assumed that facility development and visitor use would alter an area's biodiversity, so development plans, including areas of visitor use, were analyzed for their affects on biodiversity.

Impact Analysis

The development of a visitor center in the flats in Boca Negra Canyon, an administrative office, maintenance facilities, and the petroglyph research center at Lava Shadows, and parking and visitor contact facilities at Rinconada, Mesa Prieta, and Piedras Marcadas would eliminate 15.5 acres of flat dune habitat. Pedestrian trails would impact another 5 acres of the narrow zone at the base of the escarpment. The presence of visitors in areas not now visited might displace some species of wildlife, although this is not anticipated to be significant. About 35 acres of other lands would also be affected by development.

Horse use on the mesa top would adversely affect biodiversity through the

introduction and spread of exotic plants. However, most of the monument has been previously disturbed by extensive grazing, and many of the prominent plants are exotic species. Thus, horse use would not be a significant impact. Restoring and revegetating 20-30 miles (approximately 30 acres) of dirt roads and trails and 15 acres of other disturbed land including Homestead Circle park, Calle Norteña, and the mined area at the volcanoes, would have a beneficial impact on biodiversity by increasing available habitat. Restricting visitor use in a large portion of the volcanoes area would also improve biodiversity.

Conclusion

The acreage developed, 55 acres, represents 0.7% of the total habitat available; thus, this would not be a significant adverse impact. Restoring and revegetating disturbed areas would replace lost habitat.

Cumulative Impacts

The development of 55 acres might proportionally decrease wildlife and plant species and adversely impact biodiversity in the area affected, although there would be some cumulative benefits from revegetating and restoring habitat. Together with the high rate of development occurring adjacent to the monument, less habitat would remain for these populations.

The construction of Unser Boulevard by the city might have adverse impacts on biodiversity by eliminating habitat, increasing noise levels, and preventing some wildlife movement.

The monument is likely to become an isolated island of habitat that over time would have a significant adverse impact on biodiversity.

IMPACTS ON SOILS

Methods for Analyzing Impacts

Consultations were conducted with the Soil Conservation Service, and a soils map (based on the *Soil Survey of Bernalillo County and Part of Sandoval and Valencia Counties, New Mexico*, USDA 1977) was prepared using the city's geographic information system. Proposed development, including trails, were compared with the map, and the area of impact was determined.

Impact Analysis

The following tables show impacts by soil type and at developed areas to provide a more complete and understandable picture of the impacts on soils. Impacts can be seen by looking at the "Soil Characteristics/Impacts" column. For example, soils with moderate to high potential for erosion (by wind or water) would be impacted by development and vegetation removal more than soils with slight to moderate potential for erosion.

During construction, requirements such as watering and immediate revegetation efforts would mitigate adverse impacts on these soils.

After construction is complete, impacts on soils would include compaction from visitor use. No other impacts would be anticipated. Keeping visitors only on established trails would prevent further erosion, vegetation removal, and compaction that all result in adverse impacts on soils. Mine reclamation around the volcanoes and revegetating dirt roads, trails, and other disturbed areas would have a beneficial effect on soils by

stabilizing sites and creating environments where vegetation would grow.

Conclusion

The development on about 55 acres of soils within the monument would result in adverse impacts on soils. These impacts are significant because soils support plant and wildlife habitat and contribute to the health of the west mesa ecosystem. However restoring about 50 acres of other disturbed land would offset this impact. No impacts on soils would be anticipated after construction. Keeping visitors only on established trails would prevent further erosion, vegetation removal, and compaction. Impacts on soils would not be significant.

Cumulative Impacts

Facility development combined with adjacent development including Unser Boulevard would cumulatively adversely impact soils.

IMPACTS ON SCENIC RESOURCES

Methods for Analyzing Impacts

The alternatives are evaluated by considering the impacts of the proposed developments on the monument scenery. Each proposed development area was visited to document existing views. The monument scenery within the boundaries is dominated by the natural landforms and typical regional vegetation, with relatively few modern intrusions. However, the monument scenery is also influenced by the surrounding suburban development, which creates an already negative effect on

TABLE 13. AFFECTED SOILS AND CHARACTERISTICS

Soil Type	Soil Characteristics/Impacts
Bluepoint-Kokan association, hilly	Slow runoff potential. Moderate to severe potential for erosion by water.
Bluepoint loamy fine sand, 1-9% slopes.	Slow runoff potential. Severe potential for erosion by wind.
Akela-Rock outcrop complex, 1-9% slopes.	Medium runoff potential. Light or moderate potential for erosion by water.
Alemeda sandy loam, 0-5% slopes	Medium runoff potential. Moderate to severe potential for erosion by wind and slight potential for erosion by water.
Madurez-Wink, gently sloping	Slow runoff potential. Gently sloping. Moderate to severe potential for erosion by wind.
Rock outcrop-Akela complex 10-50% slopes	Medium runoff potential. Slight to moderate potential for erosion by water.
Kokan-Rock outcrop	Rapid runoff potential. Slight potential for erosion by water.
Latene sandy loam, 1-5% slopes	Medium runoff potential. Moderate potential for erosion by water or wind.

TABLE 14. SOIL IMPACTS BY DEVELOPED AREA, ALTERNATIVE 1, PROPOSED ACTION

Developed Area	Acres of Moderate to Highly Erodible Soils Affected
Rinconada Canyon	Bluepoint-Kokan, hilly; Bluepoint loamy fine sand, 1-9% slopes; Kokan-Rock outcrop
Piedras Marcadas Canyon	Bluepoint-Kokan, hilly
Lava Shadows	Bluepoint-Kokan, hilly
Boca Negra Canyon	Bluepoint-Kokan, hilly
Administrative facility, south of Boca Negra Canyon	Bluepoint-Kokan, hilly
Volcanoes area	Akela Rock outcrop; Alemeda sandy loam, 0-5% slopes; Rock outcrop-Akela, 10-50% slopes
Piedras Marcadas ruin area	Bluepoint-Kokan, hilly
Homestead Circle park	Bluepoint-Kokan, hilly; however, site restoration would be result in beneficial impact
Pedestrian trails	Alemeda sandy loam, 0-5% slopes; Bluepoint, loamy fine sand, 1-9% slopes; Bluepoint-Kokan, hilly
Multipurpose trails	Akela Rock outcrop; Madurez-Wink, gently sloping; Alemeda sandy loam, 0-5% slopes; Rock outcrop-Akela complex, 10-50% slopes; Bluepoint loamy fine sand
Mesa Prieta	Bluepoint-Kokan, hilly
Neighborhood access trails	Kokan Rock outcrop
81st Street	Alemeda sandy loam, 0-5% slopes; Madurez-Wink

the overall quality of the visual resources at the monument boundaries. All proposed development is considered within the context of this existing scenery.

Impact Analysis

Locating major monument facilities close to or adjacent to the monument boundary

where suburban development does or will exist would reduce the adverse visual impact of new development. This would relate the facilities more closely to the neighborhood context. Keeping parking areas, visitor contact stations, and access points closely associated to city streets, would minimize incursions into the monument and have less adverse impacts. Locating less intrusive development such as pedestrian trails in the more naturally scenic areas of the monument would be an adverse visual intrusion. Development at the volcanoes area would be slightly more visible because visitor information, restrooms, and parking are further within the natural scenery surrounding the volcanoes and there is no nearby suburban development to moderate the effect of development in this area.

Having all facilities of the highest quality design to sensitively blend in with the monument surroundings would reduce negative impacts to the greatest degree possible. Development sites would be selected to minimize visual impacts. Visual impacts of structures would be further minimized by screening structures with topography and vegetation. (Only local native vegetation that was compatible with the cultural landscape would be used.) These would be sensitively built, attractive buildings that would change the scene from a predominantly natural one to one that has monument development.

The natural scenery at Boca Negra, the visitor center location, has already been impacted by existing development. Thus, adverse impacts on the visual quality from additional development would be minimized.

The natural condition of the area south of Rinconada Mesa would be impacted by the future heritage education center. The views of the mesa top would be affected by the increased presence of visitors on the

escarpment trails and overlooks. Cars, horseback riders, and bicycle riders might be occasionally sighted in the vicinity of 81st Street. Locating roads, parking, and trails back from the escarpment rim would minimize these intrusions; however, some access points to overlook the city would be visible when looking at the mesa from the east.

Black Volcano offers expansive views of the mesa, the city, and the Sandias. This view would be affected by trail development and the increased presence of visitors on the scene when overlooking the mesa from the volcanoes area.

Many areas of the monument have been disturbed by uncontrolled uses such as all-terrain vehicles, biking, hiking use, walking dogs, illegal dumping, and gun target practice. These uses have degraded the scenery of the monument over a long period of time. The management or prohibition of these uses, as well as restoration and native revegetation programs, would return these disturbed areas to their original natural character and improve the scenic quality.

Conclusion

This alternative would preserve much of the monument in its natural state. New facilities would have adverse impacts on temporary negative impacts on the scenic quality during the period of construction.

Construction equipment, clearing and grading operations, dust, etc., would create the natural and cultural environment at selected areas.

Cumulative Impacts

The proposals in this alternative would result in preserving large areas of the

monument in its existing natural state. In addition, trash removal and revegetation programs would restore large portions of the monument to its natural character. Therefore, the alternative would contribute to local efforts to preserve the existing scenic resources of the west mesa. These efforts would combine to produce beneficial visual impacts. The visitor facilities would contribute a minor increase to the overall adverse visual impact of suburban development of the area. Development adjacent to the monument combined with the city's construction of Unser Boulevard through the monument would adversely affect scenic quality and views from the monument.

IMPACTS ON THE LOCAL AND REGIONAL ECONOMY

Methods for Analyzing Impacts

All recent information on visitor use was gathered, and a market segmentation analysis was conducted. Socioeconomic impacts were generated through analyzing the local and regional socioeconomic environment. Economic data, historic visitor use data, projections of future visitor use, and the future development of the monument were all considered in identifying and discussing the expected impacts. Although it is not possible to accurately project visitor use, based on a market analysis and visitor use at similar national park system areas the Park Service projects about 189,000 visitors annually by the year 2000 and 283,000 visitors annually by the year 2010 (see appendix O).

The NPS Socioeconomic Studies Division (WASO-TNT) has developed an economic model called the money generation model to develop dollar estimates of economic

impacts and estimates of jobs that would be created or supported by the monument. The model was designed as a means of inexpensively computing the approximate economic benefits generated by monument-related tourism. This model is not very complex nor all encompassing. It was designed to be used by monument staff who may have little or no expertise in economics. A limitation of all models is that the output from a model is only as accurate as the data that is input into it. This is true of all models. A conservative value is presented using the best available information. This economic impact represents the current situation as the data used is the most current available.

The model is dependent on accurate visitor use data, which in this case is not available. Monument visitation of 88,059 in 1994 and value of 1.6 hours were used for the average length of stay to determine the number of visitor days necessary to run the model. If the actual number of visitors were to be significantly different than this figure, then the results of the model would be significantly affected.

The model does not estimate precisely the economic benefits derived by the local and regional economy due to the operation of the monument. It does, however, give decision makers some indication of the economic impacts of the monument. For instance, when compared to the 1993 total retail sales figure for Bernalillo County of \$4,487, 419,000 (source: New Mexico Taxation and Revenue Department), even the estimated total sales benefits of \$1.9 million is not, relatively, a large amount. Although the monument will contribute to the local economy in a positive way, it will not be a major factor in the overall economy of the region. Results of the application of the model are presented in the following table.

TABLE 15. APPLICATION OF THE MONEY GENERATION MODEL FOR 1994 AND 2004

Combined Benefits Due To:	1994	2004
Increased Sales	\$ 1,943,800	\$10,292,200
Additional Taxes	\$ 139,800	\$740,000
New Non-Monument Jobs Created or Supported	59	309

SOURCE: National Park Service, Denver Service Center, Central Team, Branch of Planning

* The money generation model was run using projected visitation and projected monument budget for 2004 instead of current data. All other data remain the same. This assumes that *Ceritus Paribus* all other variables remain the same over time. This is not likely, but given this assumption allows some speculation about the future economic impact of the monument.

Impact Analysis

The creation of the monument so close to the city has given the city new status. The protection and management of monument resources would enhance aesthetic, biological, cultural, economic, geologic, historic, natural, and recreational resource values of the Albuquerque area — and add to the quality of life in Albuquerque. However, many of these values are extremely difficult and costly to measure. This is especially true of the "nonuse" values, such as scenery or the preservation of archaeological sites and cultural landscapes. A dollar value is difficult to assign to these items, yet people do value these things. These benefits would continue into the future.

Monetary benefits could accrue to individuals, businesses, and the city in general through increased tourism. Not only would more visitors be encouraged to come to the city, but those who do might stay longer to see and enjoy the monument.

Another monetary benefit attributable to the monument would be increases in property values. Studies have shown that property near parks has a higher value than property further away from parks.

The establishment and development of the monument has and will continue to influence real property values in a positive manner. It then follows that property tax revenues would increase over the years as real property near the monument is revalued for real estate tax purposes.

To speculate regarding the economic impact of the monument in the future, the money generation model was rerun using the visitation figure projected for the monument by the Socioeconomic Studies Division. Estimated visitation is forecast at 245,000 visitors for the year 2004. The National Park Service budget for the proposed action is \$3.3 million. Projected city expenditures for the monument are \$1.1 million. Compounding this figure by 4% for inflation makes the 2004 monument budget about \$4.9 million. The results of this projection and analysis are presented in table 15. It is assumed that all other variables would remain static over time. Even though this is an unrealistic assumption, it is necessary to make it in order to estimate the potential economic impact of the monument. Performing this type of sensitivity analysis allows comparison of the current situation regarding economic impacts with the future. The forecasted level of visitation and monument budget lead to the expectation that the monument

will increase its contribution to the local economy as shown in table 15.

Also, the monument is one more positive inducement for industry and business to locate in the Albuquerque area because of the perceived improvement to the quality of life it contributes. The planned development of the monument would be a boost to the economic life and growth of the region because of the values it protects.

Concerns have been expressed that the monument might hinder the development and westward expansion of the city. This is unfounded; there are plans to improve access via a realigned Unser Boulevard, and I-40 provides ready access to the west. Reasonable and viable alternatives exist to the Paseo del Norte extension. As pointed out above, the values that the monument protects encourage the growth and economic development of the Albuquerque region.

Conclusion

Monument establishment and development has had and will continue to provide positive economic benefits for the Albuquerque area. Although the direct economic benefits might be relatively small in relation to the entire economy of the region, they are significant. Even more significant might be the unquantifiable positive benefits that accrue to the region due to the monument's existence and development and the quality of life values it provides and protects.

Cumulative Impacts

Petroglyph National Monument is an economic plus for the city and would become a premier attraction of the city and the region. The development of the monument would lead to increased visitor use

of the monument and increased tourism in the city and area. Thus, positive economic benefits would accrue to the local economy.

The city's construction of Unser Boulevard the recreational trail and the utility corridor would benefit the local and regional economy by facilitating traffic flow, reducing traffic congestion on other roads, allowing for enjoyment of monument resources, and providing utilities to the mesa top. However, because of the need to minimize impacts on monument resources, there would be increased design and construction costs.

IMPACTS ON NATIONAL VISITORS

Methods for Analyzing Impacts

The alternatives are analyzed by looking at the opportunities for visitors to understand and appreciate the values for which the monument was set aside, to experience the monument in a variety of ways, and to have programs and facilities for people of varying abilities, including visitors with disabilities.

A transit system evaluation was conducted by a consultant to address concerns raised during scoping.

Impact Analysis

Implementing the proposed action would allow visitors to see petroglyphs in the context in which they were created. Except for the addition of constructed trails and petroglyph viewing areas, the inner canyons would appear much as they did in prehistoric times. High-use trails in the outer portions of the canyons, and less improved trails in the inner portions of the canyons would provide a diversity of experiences for all visitors. Visitors who

are able and willing to hike to the back of the canyons could see petroglyphs with a sense of solitude.

The improved parking area and interpretive viewing site on Black Volcano would permit visitors to better understand the entire landscape. The interpretation of the connections the Pueblo Indians make between the escarpment and the volcanoes could be better explained from this vantage point.

Constructing a visitor center/interim heritage education center in Boca Negra Canyon would provide visitor orientation and introduction to the monument and the significance of the resources and offer a place for schoolchildren and other groups to learn about the monument. Easy and close access from the visitor center to some petroglyphs would accommodate visitors of different ages and abilities and offer greater opportunities for effective interpretation, both having positive impacts on visitors. Boca Negra Canyon's central location would be convenient for visitors who choose to go north or south to other petroglyph concentrations. The development of a horse tie-up area near the visitor center would be sited to avoid any potential conflicts with visitors.

Constructing a permanent heritage education center would permit organized groups to have a quality educational experience in an exceptional resource. The Mesa Prieta area, in contrast to Boca Negra, would provide visitors with a more isolated experience because the topography separates it from surrounding land use. The separation of the visitor center and heritage education center would enhance experiences for both visitors and schoolchildren. Typically, students stay longer at the facility than visitors. The Mesa Prieta area would provide more space to accommodate a heritage education program. Additionally, the combined use of trails by

public visitors and educational groups in high-use areas could lead to congestion and seriously diminish the experience for both groups of visitors.

Based on current information, it would not be cost-effective to implement a transit system under alternative 1. Further analysis of visitor use patterns would be required (Balloffet 1994b).

Noise levels from development near the Piedras Marcadas Pueblo ruin would increase and adversely affect the site and visitors.

Conclusion

Visitor experience would be improved by preserving the escarpment in its natural state and restricting development within the monument.

Cumulative Impacts

Over time a more positive experience for visitors, schoolchildren, and other organized groups would be provided as a result of implementing this alternative. Resources would be better protected, and visitors could gain a greater understanding and appreciation for the purposes for which the monument was set aside.

The construction of Unser Boulevard and the recreational trail by the city would benefit national visitors by facilitating access to the mesa top by vehicles, bicycles, horseback, and foot. There would also be a beneficial impact of eliminating vehicular traffic in Boca Negra Canyon. There would be adverse impacts on visitors by the visual intrusion, increased noise levels, and the barrier of the four-lane highway. Creative design and material use would minimize these impacts.

IMPACTS ON LOCAL VISITORS AND ADJACENT LANDOWNERS

Methods for Analyzing Impacts

Proposed actions for development and visitor activity were compared with existing uses that occur on monument lands, both by the local public and adjacent landowners. A transportation consultant was hired to evaluate traffic impacts and address concerns raised by neighborhoods and the city Public Works Department.

Impact Analysis

There would be some increased traffic from visitors on Unser Boulevard, but there would be no adverse impacts on residents who use this road for access to their homes. Although parking would be provided for visitors, increased traffic could occur on neighborhood streets, adversely impacting residents in adjacent neighborhoods, including Santa Fe Village, Taylor Ranch, and Laurelwood. If these impacts become significant, parking regulations, signs, and a visitor transit system would be further evaluated.

Local residents might also be adversely impacted by mesa-top visitors who travel off trails to the rim and look over into backyards, thus affecting privacy. Although the number of visitors who do this would be small, any occurrence might be significant to neighborhood residents.

Regulating horse and bicycle riding and restricting all visitors to trails would prevent erosion and potential safety problems that have affected other park system units that have allowed unregulated horse and bicycle use. Visitors wanting solitude would not be able to find it as easily and might have to go elsewhere.

Constructing three multiuse trail escarpment crossings and the multiuse trails on the mesa top would have a positive impact on people who like to hike, bicycle, and horseback ride on the mesa top. Constructing the multiuse trail in the northern portion of the monument would have a positive impact on users who want a longer trail experience in the monument.

Local residents would benefit most because multiuse trails on the mesa top would tie into a city trail system already planned and in some cases constructed outside the monument. Constructing a horse tie-up area near the visitor center would have a beneficial impact on visitors who would travel to the monument on horseback. Visitors looking for solitude would be disappointed and displaced.

Noise levels from development near the Piedras Marcadas Pueblo ruin would increase and adversely affect the site and visitors.

There might be impacts on adjacent landowners because of stormwater management and utility crossing constraints. Federal law requires that there be no degradation of monument resources, even if there is additional cost. Adjacent landowners would also be affected by additional time for consultation, design, construction standards, and compliance with the National Environmental Policy Act and the National Historic Preservation Act, required to prevent impacts on monument resources.

Conclusion

There would be minor increases in traffic and no adverse effects from monument visitation (Balloffet 1994a). This alternative would have generally beneficial effects on the local visitors and adjacent landowners because of greater protection of monument

resources and accommodation of uses that the Albuquerque public desires. In general, greater access would be allowed to the monument than now exists but in a way that ensures better resource protection.

There would be impacts on adjacent landowners because of federal laws that require that there be no degradation of monument resources and because of the additional time for consultation, design, construction standards, and compliance with the National Environmental Policy Act and the National Historic Preservation Act that would be required to prevent impacts on monument resources.

Cumulative Impacts

The construction of Unser Boulevard, the recreational trail, and the utility corridor by the city would benefit adjacent landowners and local visitors by facilitating access and allowing the enjoyment of monument resources. Adjacent landowners west of the escarpment would also benefit from the utility access. There would be adverse impacts from visual and noise intrusions from traffic on Unser Boulevard. Creative design and material use would minimize these impacts.

IMPACTS ON ENERGY CONSUMPTION

Methods for Analyzing Impacts

Energy consumption impacts were analyzed by applying sustainable design principles and experience in other units of the national park system.

Impact Analysis

Energy conservation measures incorporated in facility development would

reduce adverse impacts from increased energy consumption from facility development and use. Planning for alternative means of transportation in the monument identifies opportunities for energy savings. For example, each development area could be reached by auto as well as other transportation such as bicycles, foot, and horse to assess the viability of shuttle bus and transit systems. Further studies would be needed as monument facilities are developed and visitor use patterns take shape.

The use of energy-saving devices, such as timers and sensors for lighting, high efficiency insulation, passive and active solar heating, fresh air ventilation, and maximized daylight in building design for each of the development areas would help conserve energy. Using locally available materials would also reduce energy consumption used to transport building materials. The combination of these devices would result in reducing the adverse effects from increased energy consumption of new facilities.

Conclusion

Incorporating and promoting energy conservation in the planning and design of the monument facilities would mitigate most of the adverse impacts of increased energy consumption.

Cumulative Impacts

The facilities in the monument would contribute to increasing demand for energy in the area. Energy conservation measures of the monument facilities would mitigate much of the adverse energy consumption impacts.

IMPACTS OF MONUMENT USE AND ACTIVITIES ON EXISTING NOISE LEVELS

Methods for Analyzing Impacts

Four sources of information were used to analyze the impacts on noise levels — the *Traffic Impact Evaluation* by Balloffet and Associates, Inc. (1994a); the *Unser Middle Transportation Corridor Study, Final Environmental Impact Statement* by Leedshill-Herkenhoff Inc. (1992); noise level monitoring of sites within the monument in 1993 and 1995; and the cumulative experience of the National Park Service with the construction and development of facilities at other national park system units.

The *Traffic Impact Evaluation* analyzes the potential traffic impacts associated with the operation of Petroglyph National Monument by looking at trip generation and distribution to determine traffic volumes in comparison to forecasted residential and commercial travel on the Albuquerque street system.

The *Unser Middle Transportation Corridor Study* used 1990 and 2010 traffic volumes to measure average existing peak hour noise levels and projected future noise levels at sites within and adjacent to the monument.

Petroglyph National Monument staff used an integrated sound level meter to conduct measurements of noise levels at 21 sites through the monument, with the exception of the Mesa Prieta and southern geologic window. These studies were conducted in 1993 and repeated in 1995 to collect baseline noise level data.

Impact Analysis

Noise levels would increase during construction in areas being developed. Construction noise would be temporary and not significant.

Increased noise from cars, recreational vehicles, and buses entering and leaving parking areas would not be significant and would likely be less than surrounding traffic and urban noise levels.

Traffic volumes expected to and from the monument would be small compared to forecasted travel on the street system resulting from residential and commercial sources (Balloffet and Associates, Inc. 1994a)

The greatest increase in noise would probably be at the area between Mesa Prieta and Unser Boulevard (if the heritage education center is developed on the proposed site) from traffic and buses bringing organized groups and for educational activities. This area does not currently have road access. Adjacent neighborhood development is currently being planned, which would likely be in place before a heritage education facility and parking area is constructed. Therefore, as in other areas, increased noise from visitor activity would be significantly less than adjacent neighborhood noise levels.

Adjacent neighborhood noise and traffic from local streets including Unser and Coors Boulevards would have a greater adverse impact than that generated by development at Boca Negra, Piedras Marcadas, and Rinconada Canyons, the Mesa Prieta, and the Piedras Marcadas Pueblo ruin.

Visitor use activities in the volcanoes area would increase noise levels but would not be a significant adverse impact.

Conclusion

Noise from monument development and operations would not have a significant impact.

Cumulative Impacts

It is expected that noise from proposed adjacent development near Mesa Prieta, Boca Negra and Piedras Marcadas Canyons, the Piedras Marcadas Pueblo ruin, and the volcanoes would adversely affect the monument. Combined noise levels from Unser Boulevard, the expansion of the Double Eagle II Airport, proposed Paseo del Volcan, and proposed adjacent development could cumulatively and significantly increase noise levels in the monument. Mitigation measures regarding Unser Boulevard, the airport, and Paseo del Volcan would be developed with the Federal Aviation Administration, the state, and the city.

IMPACTS ON AIR QUALITY

Methods for Analyzing Impacts

A 1990 amendment to the Clean Air Act (section 176[c]) requires that the National Park Service analyze the impacts of the development proposed in the general management plan, including visitor traffic and staff commutes, on the city's ability to maintain conformity with the required air quality standards as determined by the Environmental Protection Agency. The city of Albuquerque has been determined to be a nonattainment area for carbon monoxide. However, this status may soon be reviewed and changed to reflect three consecutive years without violation of these standards. For purposes of impact assessment, the National Park Service has estimated that up to 500,000 visitors may visit the monument annually by the year

2010, when all facilities are constructed and the monument is in full operation. Based on this figure, parking spaces for 55 automobiles and 15 oversize vehicles (buses, RVs, etc.) would be required at the visitor center. Parking spaces would also be provided at the administrative/petroglyph research center, the heritage education facility, and trailheads. Using this information, the amount of carbon monoxide emitted annually was calculated.

The National Park Service contracted with Balloffet and Associates to assist in analyzing the potential traffic impacts associated with the operation of Petroglyph National Monument by looking at trip generation and distribution to determine traffic volumes in comparison to forecasted residential and commercial travel on the Albuquerque street system (Balloffet and Associates, Inc. 1994a).

Impact Analysis

The construction of these facilities would result in temporary increases in inhalable particles (dust) and mobile source emissions (e.g., carbon monoxide, nitrogen oxides, and volatile organic compounds). During construction, dust suppression and other mitigating measures used would minimize temporary adverse effects on air quality.

It was calculated that once the monument is fully staffed, federal employees commuting back and forth from home to work would travel 634 miles per day. This represents 4.3 pounds per day of carbon monoxide emissions. It is assumed that approximately two-thirds of these employees would not be traveling during peak hours.

Additionally, visitors would travel approximately 10 miles round-trip from the interchange with I-40 and Unser

Boulevard to the visitor center at Boca Negra Canyon. This would contribute approximately 155.8 pounds per day of carbon monoxide emissions. It is assumed that visitors would not be traveling during peak hours. A total of 160.1 pounds per day of carbon monoxide emissions would be generated by visitors and federal monument staff. There would be no known indirect emissions. These total emissions are below de minimus levels (the maximum amount of carbon monoxide allowed to be emitted per year, which in this case is 100 tons per year) as described in the Environmental Protection Agency's general conformity regulation; therefore this action is exempt from conformity. However, employees would be encouraged to use the city transit system as well as carpool to further reduce emissions.

Due to the lack of information available to determine emission levels generated by construction activity, conformity would be determined during the design phase for proposed development sites. If required, construction would be designed to ensure conformity. Limiting the number of trips, traveling during nonpeak hours only, suppressing dust, and using other methods would be required if necessary to ensure that conformity is met. Other emissions, such as ozone, particulates, and lead, would be under de minimus levels as set in the regulations pertaining to nonattainment areas.

Conclusion

Overall, the effects on air quality would be minor. No state or federal air quality standards would be exceeded. The emissions generated within the monument from the preferred alternative (and the other alternatives) would not exceed de minimus levels (100 tons per year for carbon monoxide) as described in the

Environmental Protection Agency's general conformity regulations (section 176 [c] of the 1990 Clean Air Act amendments). Temporary adverse impacts might occur during construction from dust, but they would not be significant.

Cumulative Impacts

Particulate matter (dust) from constructing proposed monument facilities combined with adjacent construction including Unser Boulevard, Double Eagle II airport, and Paseo del Volcan would have temporary adverse impacts on air quality. The use of adjacent roads and development and the airport would increase emissions.

UNAVOIDABLE ADVERSE IMPACTS

Developing facilities and providing a quality visitor experience would increase visitation and change the nature of the experience from what exists today. This might be perceived to be an adverse impact on the monument resources by some groups and individuals.

Adjacent residents would no longer be able to access the monument from their backyards on social trails of their own design. All visitors would be required to use established access points to the mesa top and canyons. This might be perceived by some adjacent landowners and local residents to be an adverse impact on their ability to enjoy the monument resources.

A total of about 55 acres of biotic communities, wildlife and wildlife habitat, soils, and associated biodiversity would be adversely impacted by the development of visitor facilities.

Additionally, the construction of Unser Boulevard through the monument would adversely impact the above resources.

Several archeological sites could be negatively affected by construction and unauthorized visitor use and vandalism. There would also be impacts on the integrity and character of the cultural landscape resources and on the scenic qualities of the cultural landscape.

RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The construction of visitor facilities and trails on 55 acres and increasing visitor use of areas now not visited by many people would cause a long-term decrease of natural biological productivity. Although these changes are reversible in the long term and the natural biological productivity could return to the area, it would be unlikely in the foreseeable future, and the extent of adjacent development makes it even less likely. The monument, partly within the Albuquerque city limits, has likely already experienced changes in productivity due to the extent and type of development occurring adjacent to the west mesa.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Although all archeological sites would be avoided where possible, or disturbance would be mitigated through the recovery of cultural information and significant artifacts, some losses of archeological objects and cultural information would be likely due to vandalism, illegal collecting, or construction activities. These losses would be irretrievable.

The habitat for the *Pediocactus papyracanthus* and *Mammillaria wrightii* cacti would be adversely affected by visitor activity and development. The ferruginous hawk could be eliminated as a breeding species in this area. If all these species continue to decline elsewhere to the point of extinction, this loss would be irretrievable and at least partially attributable to implementing the proposed action.

Although most developed areas could be restored to previous conditions over time, the use of land, wildlife habitat, and financial resources to implement the proposed action would, in the practical sense, be an irretrievable commitment of resources.

IMPACTS OF IMPLEMENTING ALTERNATIVE 2

IMPACTS ON CULTURAL RESOURCES

Impact Analysis on Petroglyphs

Fewer petroglyphs would be exposed to risk from vandalism and inadvertent damage because the visitor center area would not provide easy access to large numbers of petroglyphs and access to Rinconada Canyon would be more difficult. Also, fewer visitors would have the opportunity to see the petroglyphs because of the more difficult access. Education, understanding and appreciation of petroglyphs are critical components of the petroglyph protection program. Loss of educational opportunities could increase the risk of vandalism because of the lack of visitor understanding and appreciation for petroglyphs. (See table 16 below for potentially affected sites, effects of this alternative upon resources, proposed protective measures, and further 106 compliance needed.)

Redesign of the trails and viewing areas at Boca Negra Canyon would have a positive effect upon the petroglyphs and their context by providing established viewing areas and by removing trails that wind through and between petroglyph concentrations or are too close to the features.

Locating facilities within Mesa Prieta and Piedras Marcadas Canyon would increase visitation in areas where little visitation has occurred, which could result in some increased risk for damage to the petroglyphs.

There would be less impact on the cultural landscape in this alternative than in alternative 1 because development is generally focussed in previously disturbed areas.

The petroglyph research center would promote research regarding and public education and appreciation of the petroglyphs, and resource management and center staff would develop ways to conserve the petroglyphs and repair vandalism — all of which would be positive impacts on petroglyphs.

Impact Analysis on Archeological Sites

Visitor contact and information centers at Mesa Prieta, Piedras Marcadas Canyon, and Piedras Marcadas Pueblo ruin would have about the same impact as in alternative 1. There would be no adverse effects at Lava Shadows and no effects from developing the heritage education center. There might be an impact on one site at the 81st Street overlook site, which the Park Service would try to avoid during specific site location and design.

Fewer indirect impacts from visitor use would be expected because the development is focused into previously disturbed areas at Boca Negra Canyon and Lava Shadows. Frequent patrols and law enforcement would reduce potential for adverse impacts on sites in outlying areas (Rinconada Canyon and the mesa top). Less development near the boundary in the nonfederal protected area might mean less risk of vandalism and destruction of sites in the monument; however, a number of factors, such as ease of access, could result in a different outcome.

Reclaiming abandoned mine sites could potentially adversely impact unknown archeological resources at the volcanoes.

See table below for a summary of effects, mitigation, and further compliance needed.

TABLE 16. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 2 ON CULTURAL RESOURCES LISTED ON OR ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES, PROPOSED PROTECTIVE MEASURES, AND REQUIRED COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT.

Note: The entire monument, Boca Negra Cave, Las Imagines Archeological District, and the Piedras Marcadas Pueblo ruin are all listed on the national register. Cultural resources include cultural landscape, archeological and

ethnographic sites, and petroglyphs. Unless otherwise noted in the following table, construction could probably avoid sites.

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Lava Shadows — No known resources in immediate area of existing structures; see alternative 1 for further information on entire development area.	Remove existing nonhistoric facilities; construct visitor center, parking, trails, trailhead, access road.	With mitigation, no adverse effect.	• When removing facilities, use care to avoid disturbance of unknown subsurface remains. • Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Piedras Marcadas Canyon — Sites include three prehistoric lithic scatters (one Archaic); one lithic and ceramic scatter; four prehistoric sites with stone circles, water control features, and/or lithic/ceramic scatters; at least two multicomponent sites containing prehistoric lithic scatters, grinding slicks, and/or historic herding artifacts and features. Vicinity: petroglyphs, potential cultural landscape, ethnographic sites.	Construct visitor contact facility, parking area, access road, restrooms, and trails.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion upon cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage.) • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use. • Permits would be required.	Same as above.

TABLE 16. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 2 ON CULTURAL RESOURCES (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Mesa Top at Northwest Part of Monument, near Piedras Marcadas Canyon — One site in area (prehistoric lithic and ceramic scatter, PIII-PIV). Potential cultural landscape, petroglyphs.	Construct parking, access road, trail.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Piedras Marcadas Pueblo Ruin	Develop interpretive trail; remove existing building.	With mitigation, no adverse effect	• Continued consultation with Pueblos. • Develop ruins management plan in consultation with Pueblo community, SHPO, and ACHP. • Collect, document, and stabilize to prevent erosion. • Develop mitigation plan with SHPO. • Design visitor facilities to avoid pueblo ruins or intrusion upon cultural landscape and to prevent impacts from visitor use. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitation. • Fence and patrol site.	SHPO/ACHP consultation in preparing preliminary design, mitigation plan, and ruins management plan.

TABLE 16. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 2 ON CULTURAL RESOURCES (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Southern Mesa Prieta — Seven prehistoric sites (lithic quarry and reduction/scatters, activity areas, boulder features); one historic site (corral and artifact scatters); and four multicomponent sites with historic activity areas, corrals, and/or artifact scatters; prehistoric component has lithic quarry/reduction scatters, ceramics, water catchment/rock features, agricultural fields, and/or hearths/fire cracked rock. Adjacent are petroglyphs, potential cultural landscape, ethnographic sites and historic livestock drive route. At least 12 sites in area.	Build visitor information kiosk, rest-rooms, parking, access roads, trails.	With mitigation, no adverse effect.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Boca Negra — Six adjacent sites include one stone circle (age unknown); four water and soil control structures; one historic shelter. Vicinity: petroglyphs and potential cultural landscape.	Construct heritage education facility, parking, shade structures, access road, trails.	• With mitigation, no adverse effect. • Positive effect on petroglyphs by rebuilding trail system.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor and student use. • Conduct archeological investigations, collect artifacts, and document and stabilize sites and surface features in areas adjacent to facilities and where intensive use is proposed.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.

TABLE 16. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 2 ON CULTURAL RESOURCES (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Rinconada Canyon — Petroglyphs and other archeological sites, potential cultural landscape, ethnographic sites.	Formalize pedestrian petroglyph viewing trail.	With mitigation, no adverse effect.	• Same as above. • In addition, permits would be required.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Volcanoes — Volcanoes are sensitive ethnographic resources; four prehistoric sites nearby include petroglyphs, rock shelter, lithic/ceramic scatters, and/or grinding stone; three historic sites include corrals, pre- and post-WWII historic debris, lambing pens, hearth and/or corral; one site has corral and lambing pen, rock shelter and lithic/ceramic scatters. Vicinity: potential cultural landscape, ethnographic sites.	• Retain parking area and access road for occasional tour groups. • Gate entrance • Reclaim cinder mining sites.	• With mitigation no adverse effects. Area previously impacted. Limiting public access to volcanoes would be beneficial to values held by culturally affiliated groups. Reclaiming mining sites would not occur if values of these groups would be adversely impacted.	• When rehabilitating facilities, use care to avoid disturbance of unknown subsurface remains. • Consult with American Indians to ensure no traditionally gathered resources would be disturbed. • Establish monitoring and response plan.	Same as above.
Geologic Windows — 13 sites in vicinity of proposed trails (prehistoric petroglyphs and rock features, windbreak; historic corrals, structures, shelter, and walls). Potential cultural landscape.	No action.	No adverse effect.	• Continued consultation with Pueblos. • Establish monitoring and response plan.	None.
81st Street Overlook — Potential cultural landscape. No known sites in area.	Construct parking, access road, overlook, picnic area, exhibits, trails.	No known petroglyphs, archeological or ethnographic sites would be affected. With mitigation, no adverse effect on cultural landscape.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.

TABLE 16. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 2 ON CULTURAL RESOURCES (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Mesa Top — Sites are too numerous to list, ranging from Archaic period to present. Potential cultural landscape, ethnographic sites.	• Construct pedestrian trails. • Revegetate selected roads and trails.	With mitigation, no adverse effect.	• When rehabilitating facilities, use care to avoid disturbance of unknown subsurface remains. • Design trails/facilities to avoid cultural sites or intrusion upon cultural landscape, and to reduce potential for inadvertent damage from visitor use. • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Include in monitoring and response plan. • Most trails would follow existing roads.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Neighborhood Access — Several adjacent sites, including lithic/ceramic scatters. Vicinity: petroglyphs, potential cultural landscape.	Construct neighborhood access points and trails.	With mitigation, no adverse effect	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	Same as above.
Escarpment Crossings, Boca Negra and Calle Norteña — Four sites in vicinity: one prehistoric lithic reduction site (Calle Norteña); prehistoric shelter, Anasazi water and soil control walls and terraces (Boca Negra).	Build multiuse trails crossing escarpment.	With mitigation, no adverse effect.	• Sites would be avoided. • Design escarpment crossing trails to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage).	None unless resources were found.

TABLE 16: SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 2 ON CULTURAL RESOURCES (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Homestead Circle, Taylor Ranch Road/Calle Norteña Area — One prehistoric site (lithic/ceramic scatter) in vicinity.	• Remove construction debris, restore and revegetate disturbed areas at Homestead Circle park • Develop pedestrian trail neighborhood access to mesa. • Recontour, regrade, and revegetate disturbed area at Taylor Ranch Road/Calle Norteña.	With mitigation, no adverse effect.	• No known resources in proposed development areas • Site-specific surveys would be conducted as appropriate before development.	SHPO/ACHP review of project if resources are discovered.

Impact Analysis on the Cultural Landscape

With close coordination and consultation with Pueblo Indian groups, no adverse impacts on the cultural landscape from the development at Piedras Marcadas Pueblo ruin would be expected. Because development in this alternative is generally focussed in previously disturbed areas, the only new intrusions on the cultural landscape would be the small parking area at the 81st Street overlook and the visitor facilities at Piedras Marcadas Canyon and Mesa Prieta. These facilities would be sited to minimize their visibility. There would be less impact on the cultural landscape in this alternative than in the proposed action. Limiting visitor access to the volcanoes area would have a positive impact on that area's cultural landscape and resources.

Reclaiming the cinder mines would change the nature of one of the character-defining features of the landscape. Documenting these features and monitoring during reclamation would prevent adverse effects on the landscape.

Conclusion of Impacts on Cultural Resources

There would be less impact on the cultural landscape and archeological sites in this alternative than in alternative 1 because development is generally focussed in previously disturbed areas.

Limiting visitor access to the volcanoes area would have a positive impact on that area's cultural landscape and resources.

Overall, the impacts on petroglyphs would be similar to alternative 1, but the impacts would be in different areas for each alternative because of the different location of visitor use facilities. Because facilities would not be located in Mesa Prieta or Rinconada Canyon, there would be fewer impacts on the cultural landscape.

The identification and evaluation of resources, sensitive design, and appropriate mitigating measures would help ensure that archeological sites would not be negatively impacted during and after facility development. The management of visitors as described would reduce the

potential for negative indirect impacts of concentrated use in selected areas and damage from looting and vandalism. With continued consultation, potential for direct negative impacts on ethnographic sites or Pueblo values would be minimized. Indirect effects would be difficult to evaluate, but they would not be expected to be adverse.

Cumulative Impacts on Cultural Resources

Cumulative impacts of this alternative would be similar to those described for alternative 1. There would be cumulative impacts from NPS actions combined with the city's extension of Unser Boulevard, and there might be impacts from the city's development of the recreational trail and utility corridor. Impacts would be mitigated by minimizing rights-of-way and disturbed areas and using appropriate construction techniques and design materials.

IMPACTS ON VALUES HELD BY CULTURALLY AFFILIATED GROUPS

Little if any adverse impact upon culturally affiliated groups would be expected under this alternative, except that the limiting of visitor access to the volcanoes area would result in a positive impact on values held by these groups. With no bicycles or horses on top of the mesa, there would be fewer impacts under this alternative.

Developing Piedras Marcadas Pueblo ruin only after special study and consultation with concerned Pueblo Indians would avoid impacts related to intrusion on sacred and significant areas where human

remains are likely to be present. Consultation would result in further participation and involvement by culturally affiliated groups in monument interpretive and resource protection programs.

No adverse impacts on areas of spiritual significance would occur from reclaiming abandoned mining sites because reclamation would not occur if Pueblo Indians had strong objections.

Conclusion

There might be positive impacts on the values held by these groups through participation in consultation regarding site protection and interpretation. No adverse impacts would occur from reclaiming mine sites.

Cumulative Impacts

The cumulative adverse impacts on values held by these groups under this alternative would be similar but less than described for alternative 1. Because fewer visitors would have access to the volcanoes area and there would be no bicycle or horse use in the monument, there would be fewer long-term adverse impacts on resources that are sensitive to culturally affiliated groups. Privacy for religious activities might be easier to achieve, contributing to continuation of traditional activities in the future.

The city's construction of Unser Boulevard through the monument escarpment is opposed by American Indian groups and the Atrisco heirs. There would be adverse impacts on these groups and their ability to maintain their connections to the monument.

IMPACTS ON FEDERAL AND STATE THREATENED AND ENDANGERED SPECIES

Impact Analysis on Plants

Section 7 consultation would be conducted with the U.S. Fish and Wildlife Service for the *Pediocactus papyracanthus* and *Mammillaria wrightii* cactus species. About 7.5 acres of potential habitat for the two cacti would be adversely impacted by trails and visitor activity.

Conclusion. The 7.5 acres of potential habitat for the *Pediocactus papyracanthus* and *Mammillaria wrightii* cacti represents 0.10% of the total potential habitat and would not be a significant adverse impact within the monument.

With the mesa-top lands in the monument being managed for pedestrian use only, along with the 2,200 acres of open space lands north of the monument, there would be fewer people on the mesa top than in the other alternatives and less disturbance to habitat for the *Pediocactus papyracanthus* and *Mammillaria wrightii*.

Cumulative Impacts. Destruction of further habitat could eliminate the opportunity for these cactus species to populate this area and thus could contribute to the overall decline of these species. As more and more habitat is developed outside the monument by the private sector, habitat within the monument would become more valuable, and development actions under this alternative could incrementally increase the amount and severity of potential impacts on these cacti.

As in alternative 1, these impacts would be mitigated by site-specific surveys conducted before the city's construction of Unser Boulevard and the recreational trail

to ensure that no threatened or endangered species were present.

Impact Analysis on Birds

Impacts would be similar to those described under the proposed action alternative.

Development would disturb and adversely impact the ferruginous hawk during its nesting period. Pedestrian use only in the entire monument might result in fewer visitors to the mesa top, thereby providing more privacy to the hawk.

Conclusion. Managing the monument for pedestrian use only, along with the 2,200 acres of open space lands north of the monument, might have less adverse impacts on the ferruginous hawk than in alternative 1. Pedestrian trails would be located far enough back from the escarpment edge (at least 100 meters; National Biological Survey, Greg Farley, ornithologist, pers. comm. August 10, 1994) to avoid adverse impacts on potential nesting areas. Mitigation might include closing trails from February 1 to July 1 to avoid disturbing the hawks during sensitive nesting periods. Development in areas that have been closed to the public would likely adversely affect the hawk, causing disturbance and visitor activity in an area that is currently closed to the public and undisturbed.

Cumulative Impacts. Developing certain sites in the monument, combined with adjacent residential development outside the monument boundary and the city's construction of Unser, might disturb the ferruginous hawks, causing them to abandon the area. This would contribute to this species overall decline.

As in alternative 1, site-specific surveys done before the city's construction of

Unser Boulevard would ensure that no threatened or endangered species were present.

IMPACTS ON WILDLIFE OTHER THAN LISTED SPECIES

Impact Analysis on Birds

Pedestrian use on the mesa top would not adversely impact bird species. As described under the proposed action, impacts on raptor species in the Mesa Prieta area would be avoided by constructing trails far back from the rim and placing overlooks away from nesting sites. Temporary closures of nesting area sites would occur if, during certain years, nesting activity was found near overlooks. Monitoring would be conducted, and carrying capacity levels would be identified to prevent significant impact from visitors. Pedestrian use only on the mesa top would by itself limit the numbers of visitors and any associated impacts on birds. With less development and visitor use occurring in Rinconada Canyon and Mesa Prieta than under the proposed action, less bird habitat would be adversely affected than under the proposed action.

About 3.5 acres of habitat for the loggerhead shrike would be adversely impacted by facility development. There would also be adverse impacts on the crissal thrasher and sage sparrow, which occupy the same habitat as loggerhead shrikes. These impacts would not be significant.

Impact Analysis on Other Wildlife

Constructing facilities would adversely impact about 10 acres of wildlife habitat within the monument. Constructing 18 miles of pedestrian trails would adversely

impact another 13 acres of habitat. Indirect impacts on wildlife would occur as more and more adjacent land was developed.

Total acreage of wildlife habitat within the monument is 7,244 acres. The acreage distribution and percentage of the total available acreage in the monument is as follows:

	<u>Acreage</u>	<u>% of Total Monument Acreage</u>
Flat lands	1,475	20
Escarpment edge	35	<.5
Mesa top	4,534	63
Escarpment	<u>1,200</u>	17
Total	7,244 acres	

Most impacts on wildlife habitat from facility development and visitor activity would occur in the flat lands (12.5 acres), encompassing 0.8% of the total habitat available. Three acres of escarpment edge would be impacted by visitor activity, representing 8% of the total habitat available. About 9.5 acres of mesa top would be impacted by development, representing 0.20% of the total available within the monument. About 0.5 acre of the escarpment would be impacted by trails, representing 1.5% of the total within the monument.

Conclusion

No significant impacts on birds and other wildlife would be anticipated from developing facilities on 10 acres and 18 miles of trails (13 acres) in the monument.

About 23 acres of development would occur under this alternative; however, 50 acres of disturbed land would be restored, creating more available habitat for plants and wildlife. This would have a beneficial effect.

Protecting 129 acres (through the boundary addition) of wildlife habitat now proposed for development would be a beneficial impact on all species.

Cumulative Impacts

Impacts would be the similar to those described in alternative 1 plus the additional protection of 475 acres adjacent to the monument and the 129 acres within the monument from the boundary adjustment would help avoid significant adverse cumulative impacts on birds and other wildlife.

IMPACTS ON NATURAL DRAINAGE PATTERNS AND FEATURES

Impact Analysis

Hardening and compacting 13 acres for parking areas, trails, and facilities would increase sheet flow and stormwater drainage. Sheet flow would contribute to the formation of gullies and erosion of sediment and result in flooding, which would adversely impact soils, vegetation, and possibly facilities. Unlike the proposed action, trails would not be hardened on the mesa top, and there would be less interference with natural drainage patterns and features. About 40 acres of roads on the mesa top would be restored and revegetated, resulting in less gully formation. Stormwater management techniques would minimize the impacts of stormwater flows. Providing designated trails for residents living near the monument would help prevent further gullying and erosion of the escarpment edge because nearby residents would use designated trails instead of creating of social trails.

Conclusion

Hardening and compacting 13 acres for facilities and trails would increase stormwater flows in the monument. Establishing holding structures and designated trails to gain access to the mesa top and restoring about 40 miles of roads and trails on the mesa top would help prevent further gullying and erosion of soils because visitors and local residents would be less likely to create or need social trails, which contribute to impacts of erosion and gullying. This would represent an overall beneficial effect on vegetation and soils and the monument's capacity to handle stormwater. Revegetating and restoring 40 acres would also have a positive impact by eliminating existing gullies and preventing new gullies from forming.

Cumulative Impacts

Cumulative impacts would be similar to alternative 1 but slightly fewer/less because there would be fewer monument facilities. The construction of monument facilities and, in addition, the development of adjacent properties and the construction of Unser Boulevard by the city would have impacts on natural drainage patterns and features. There would be adverse impacts on natural drainage patterns within the new Unser Boulevard alignment. Positive impacts from extending Unser Boulevard would include the removal of a 1,000-foot trench that is outside the monument, which directs stormwater flows from Paradise Hills into Piedras Marcadas Canyon. Other positive impacts would be providing an opportunity to manage stormwater flows in a manner that would not adversely affect monument resources.

IMPACTS ON BIODIVERSITY

Impact Analysis

Developing an heritage education center and parking at Boca Negra Canyon, a visitor center at Lava Shadows, visitor contact stations at Piedras Marcadas Canyon and Pueblo ruin, visitor information and parking at Mesa Prieta, and trails in Piedras Marcadas, Boca Negra, Rinconada, and Mesa Prieta Canyons would impact 13 acres of flat dune habitat. The presence of large numbers of people in areas not now visited might adversely affect some species of wildlife, although this would not be significant. Restoring the Homestead Circle park site to its native condition would have a beneficial impact and add 7 acres of wildlife habitat that is currently disturbed. About 10 acres of other land would also be disturbed for development.

Reclaiming 10 acres of mined area at the volcanoes would restore habitat and contribute to the monument's biodiversity. Closing the volcanoes would also contribute to biodiversity, as would reclaiming about 50 acres of disturbed land including Homestead Circle park, Calle Norteña, and various trails, roads, and other disturbed areas.

Conclusion

About 23 acres would be developed, representing 0.30% of the total habitat available; thus, this would not likely be a significant adverse impact. About 50 acres of disturbed land would be restored, creating more available habitat and resulting in a beneficial effect on biodiversity. This

represents less development and adverse impact than under the proposed action (alternative 1).

Cumulative Impacts

Developing 23 acres might proportionally decrease wildlife species and adversely impact biodiversity in the area. About 23 acres of plant species would be eliminated, which would also contribute to an adverse impact on biodiversity. With the high rate of development occurring adjacent to the monument, less and less habitat would remain for wildlife and plant populations. Cumulative impacts would be expected to be less than under alternative 1. Restoring about 50 acres of disturbed areas would contribute to increased biodiversity.

The city's construction of Unser Boulevard, might have adverse impacts on biodiversity by eliminating habitat, increasing noise levels, and preventing some movement of wildlife.

Protecting 475 acres by other than federal means, if developed as a compatible, planned development as envisioned, would have a beneficial cumulative impact on biodiversity in the area of the monument, as would the 129-acre boundary addition. However, if dedicated open space in the 475 acres included exotic species and application of large amounts of fertilizer and herbicides and pesticides, there would be adverse impacts on biodiversity.

The monument is likely to become an isolated island of habitat that over time would have a significant adverse impacts on biodiversity.

IMPACTS ON SOILS

Impact Analysis

The following table shows impacts by soil type and at development areas to provide a more complete and understandable picture of the impacts on soils. Impacts can be seen by looking at the "Soil Characteristics/Impacts" column on table 13. For example, soils with moderate to high potential for erosion (by wind or water) would be impacted by development and vegetation removal more than soils with slight to moderate potential for erosion.

During construction, requirements such as watering and immediate revegetation efforts would mitigate adverse impacts on these soils.

After construction is complete, adverse impacts on soils would include compaction from visitor use. No other impacts would be anticipated. Keeping visitors on established trails would prevent further erosion, vegetation removal, and compaction.

Overall, impacts on soils would be less than under the proposed action because there would be less development.

Homestead Circle park would be a more natural setting than under alternative 1. Restoration of the site that has been used as a dumping ground for builders would have a positive impact because it would prevent further loss of soil from erosion.

Conclusion

Facility development on 23 acres of soils within the monument would result in an adverse impact on soils, which is important because soils support plant and wildlife habitat and contribute to the health of the west mesa ecosystem. Less

impact on soils would occur under this alternative than under the proposed action, and the impacts would not be significant.

No adverse impacts on soils would be anticipated after construction. Keeping visitors only on established trails would prevent further erosion, vegetation removal, and compaction.

Restoring 50 acres including the site near the Taylor Ranch Road and Calle Norteña, the volcanoes, and other disturbed areas, would have beneficial impacts on monument soils.

Cumulative Impacts

Cumulative impacts would be similar to alternative 1 but less/fewer because there would be less development in the monument. The 129 acres in the boundary addition and the 475 acres in the nonfederal protected area would be a positive impact.

IMPACTS ON SCENIC RESOURCES

Impact Analysis

Impacts under this alternative would not be significantly different from alternative 1. The elimination of facilities at Rinconada and the heritage education center near Mesa Prieta would decrease the adverse visual impacts of facility development by a small degree. Also, pedestrian only trails on the mesa top would eliminate the adverse visual impacts from horse and bicycle use. Adverse visual impacts would also be eliminated by leasing facilities for the petroglyph research center, which would reduce the square footage of building structures by a nominal amount within the monument. Adding 129 acres to the monument would help preserve additional scenic views. Restoring the

TABLE 17. SOIL IMPACTS BY DEVELOPED AREA, ALTERNATIVE 2

Developed Area	Acres of Moderate to Highly Erodible Soils Affected
Rinconada Canyon	Bluepoint-Kokan, hilly; Bluepoint loamy fine sand, 1-9% slopes
Piedras Marcadas Canyon	Bluepoint-Kokan, hilly; Bluepoint loamy fine sand, 1-9% slopes
Lava Shadows	Madurez-Wink, gently sloping; Bluepoint-Kokan, hilly
Boca Negra Canyon	Bluepoint-Kokan, hilly; Kokan-Rock outcrop
Volcanoes area	none
Piedras Marcadas ruin area	Bluepoint-Kokan, hilly
Homestead Circle	none
Mesa Prieta	Bluepoint-Kokan, hilly; Bluepoint loamy fine sand, 1-9% slopes
Mesa-top trails	Bluepoint loamy fine sand, 1-9% slopes; Madurez-Wink, gently sloping; Alameda sandy loam, 0-5% slopes; Akela Rock outcrop, 10-50% slopes
Neighborhood access trails	Bluepoint-Kokan, hilly; Kokan Rock outcrop; Bluepoint loamy fine sand, 1-9% slopes
81st Street addition	Latene sandy loam, 1-5% slopes

Calle Norteña area and Homestead Circle park to a more natural setting would have a beneficial effect on scenic resources.

Conclusion

The proposals of this alternative would not result in significant adverse impacts on the visual quality of the monument. However, it is expected that adjacent development would adversely impact the views from the monument.

Cumulative Impacts

The cumulative beneficial impacts of preservation and restoration would be the same as alternative 1.

Compatible development of the 475-acre nonfederal protected area adjacent to the monument and dedication and preservation of open space would have positive visual effects on the monument's scenic qualities.

The city's construction of Unser Boulevard would adversely impact the scenic views.

The overall cumulative adverse impacts for this alternative would be less than in alternative 1 due to fewer facilities proposed in the monument.

IMPACTS ON THE LOCAL AND REGIONAL ECONOMY

Impact Analysis

The analysis provided for the proposed action (alternative 1) also applies to alternative 2. It is likely that this alternative would have fewer visitors than the proposed action because access to some portions of the monument would be more difficult. Differences in positive economic impacts between alternatives would be expected, but these differences cannot be quantified.

The 81st Street boundary addition would remove 289 platted lots from private

ownership and eliminate the need for the provision of utilities and infrastructure improvements (such as roads, water, sewer, electricity, and stormwater disposal) to this area. It is likely that there would be a net savings of public funds if this area were added to the monument and acquired. Although individual homeowners would be paid the fair market value for their lots (not the perceived speculative value), removing this area from private ownership and development would impact landowners who have invested in these lots.

If the 475-acre nonfederal protected area is developed under the cluster concept, it would be expected to decrease infrastructure costs. There would be a lower overall density because of areas dedicated as open space.

Conclusion

Because visitors would have to do more hiking to see the entire monument, visitors might stay longer than they would under the proposed action. However, less development might also attract a slightly smaller number of visitors, and this would have a less positive impact on the local and regional economy than the proposed action.

At this time it is not clear if utilities would be provided for the 81st Street development by the city and how the cost for the utilities would be paid. It is likely that some combination of city tax revenues, special assessments, and individual owner contributions would be used to cover the costs. It appears that there would be a net savings to city taxpayers if the 81st Street area were added to the boundary and acquired by the city and the National Park Service.

Cumulative Impacts

Cumulative impacts would be the same as for the proposed action, except for the impacts of the 81st Street boundary addition and the nonfederal protected area. The 81st Street boundary addition and the nonfederal protected area would have long-term positive impacts on the local and regional economy by reducing expenditure of public funds. The nonfederal protected area would be an asset to the local and regional economy and enhance adjacent land values because it would demonstrate to the city, region, and nation the net high economic value of innovative, environmentally sensitive, quality development.

The city's construction of Unser Boulevard, the recreational trail, and the utility corridor would benefit the local economy; however, increase design and construction costs would be required because of needs to minimize impacts on monument resources.

IMPACTS ON NATIONAL VISITORS

Impact Analysis

Implementation of alternative 2 would allow visitors to experience the monument in a very different way than the proposed action. It provides a wider range of opportunities but accommodates fewer visitors throughout the monument than the proposed action. Most visitors would visit Boca Negra Canyon, and a smaller number would visit Piedras Marcadas and Mesa Prieta. Fewer visitors would see petroglyph concentrations in context at Rinconada Canyon.

The protection of the 129-acre boundary adjustment area would allow visitors to better appreciate the cultural landscape and views of the city and the Sandias.

With very little development in Rinconada Canyon and Mesa Prieta, other than pedestrian trails and a visitor information kiosk, visitors would see a landscape with minimal intrusions. This would be of greater value given the proximity of Albuquerque to the monument and would have a positive impact on the quality of life.

The 81st Street boundary addition and the development of the picnic area and overlook would provide visitors with an opportunity to access the mesa top by vehicle. Some view this as necessary to have a positive visitor experience.

The Mesa Prieta parking area and trail-head would provide easy access to the southern portion of the monument.

Developing a visitor contact facility in Piedras Marcadas Canyon would provide visitors with interpretation of and orientation to this resource. Numerous alcoves would separate visitor groups more effectively than in Rinconada and would provide more solitude.

The trails in Rinconada Canyon would provide visitors with opportunities for more isolated experiences while seeing the petroglyphs than found in the other petroglyph concentration areas or in the other alternatives. The canyon is considered by some to be one of the monument's principal resources, and this lack of development under this alternative would preserve its high resource values.

Because the visitor center at Lava Shadows would not be near any major petroglyph concentrations, visitors would have to walk (1 mile) or get back into their cars to see many petroglyphs. This would provide staff with the ability to direct visitors throughout the monument rather than focussing them in a few areas, which would also allow opportunities for visitors to see the petroglyphs in solitude. Visitors

would have a variety of areas to visit, some easily accessible and others that would require more time. More time would be required to see the monument under this alternative.

The heritage education center in Boca Negra Canyon would provide school and other organized groups with the opportunities to see the resources and have nearby classroom space.

Combined use of trails by public visitors and educational groups in high-use areas would lead to congestion and seriously diminish the experience for both groups of visitors.

Noise levels from development near the Piedras Marcadas Pueblo ruin would increase and adversely affect the site and visitors.

Conclusion

This alternative would provide a different experience of the monument than under the other alternatives. Visitors would have opportunities to visit large portions of the monument with a minimum of encounters with other visitors. There would likely be fewer total visitors to the entire monument because of the more difficult access. With the concentration of visitors at the Lava Shadows visitor center and Boca Negra Canyon to see the petroglyphs, these areas would be more crowded and congested than in the proposed action, making it more difficult to convey the significance of monument resources.

Cumulative Impacts

The 475-acre nonfederal protected area would benefit national as well as local visitors by creating a compatible open space area adjacent to the monument. This

compatible management area would help visitors appreciate the cultural landscape of the monument.

The cumulative impact of the city's development of Unser Boulevard and recreational trail would be the same as described in alternative 1.

IMPACTS ON LOCAL VISITORS AND ADJACENT LANDOWNERS

Impact Analysis

Impacts would be the same as described in alternative 1. Additionally, local residents would be adversely impacted by not allowing continuation of uses such as horseback riding and bicycling on the mesa top. Adding 129 acres of undeveloped land to the monument and the different development suggested for the nonfederal protected area would enhance local residents' quality of life by preserving a natural landscape so close to an urban setting.

Compatible management of open space lands adjacent to the monument (including the southern window) would preclude horse and bicycle use of this area, which could have an adverse impact on local residents by requiring them to go elsewhere for these activities. There would be more opportunities for undisturbed hiking and solitude.

As a restored natural area, Homestead Circle park would have higher scenic value to the local visitor and adjacent landowners. No adverse impacts would result due to this restoration because the site is not currently used as a developed park area. Neighborhoods could be adversely impacted by not having a neighborhood park. Because of the natural vegetation and no designated trails, the park's primary value would be its appear-

ance from outside rather than active use. Closure of the volcanoes might adversely impact local residents who consider this area a popular visitor attraction.

Noise levels from development near the Piedras Marcadas Pueblo ruin would increase and adversely affect the site and visitors.

Conclusion

This alternative would generally have a beneficial effect on the local visitor and adjacent landowners. Although more limited access is provided to the monument than under the proposed action, local visitors would be provided an experience similar to what exists today in most of the monument. Some residents would be adversely impacted by the restriction of bikes and horses except at the two escarpment crossings and no use of Homestead Circle park as a neighborhood park. Closing the volcanoes would adversely affect local residents.

Cumulative Impacts

Cumulative impacts would be the same as described in alternative 1 but slightly less because there would be fewer monument facilities. The construction of Unser Boulevard, the recreational trail, and the utility corridor by the city would benefit adjacent landowners and local visitors by facilitating access and allowing the enjoyment of monument resources. Adjacent landowners west of the escarpment would also benefit from the utility access. There would be adverse impacts from visual and noise intrusions from traffic on Unser Boulevard. Creative design and material use would minimize these impacts.

IMPACTS ON ENERGY CONSUMPTION

Impact Analysis

Energy consumption impacts for this alternative would be the same as alternative 1 except there would be slightly less energy consumption because there would be no new construction of a visitor contact station at Rinconada. There would also be approximately 25% less new trail construction than in the proposed action. Energy consumption for all other facility development would remain the same as alternative 1 and the same mitigation measures would apply.

Conclusion

Impacts would be the same as alternative 1. Incorporating and promoting energy conservation in the planning and design of the monument facilities would mitigate most of the adverse impacts of increased energy consumption.

Cumulative Impacts

Impacts would be the same as alternative 1. The facilities in the monument would contribute to increasing demand for energy in the area. Energy conservation measures of the monument facilities would mitigate much of the adverse energy consumption impacts.

IMPACTS OF MONUMENT USE AND ACTIVITIES ON EXISTING NOISE LEVELS

Impact Analysis

Noise levels would increase during construction in areas being developed. Construction noise would be temporary

and not significant. Noise levels would be similar to alternative 1. Different areas would be affected by noise resulting from visitor use. Some areas would have increases from visitor use and other areas would have less noise than alternative 1 — such as Rinconada Canyon. The Lava Shadows visitor center area would not be expected to have a significant increase in noise levels, given its proximity to Unser Boulevard. Noise levels at Mesa Prieta would also increase with the parking and visitor information station. As in the proposed action, noise levels from adjacent development at the Piedras Marcadas Pueblo ruin would increase and adversely affect the sacred nature of the site and visitors. Noise levels in Rinconada Canyon and the volcanoes would be less than that in alternative 1.

Conclusion

Impacts would be similar to alternative 1. Some areas would have more noise than alternative 1, and other areas would have less noise.

Cumulative Impacts

It is expected that noise from proposed adjacent development near Mesa Prieta, Boca Negra and Piedras Marcadas Canyons, the Piedras Marcadas Pueblo ruin, and the volcanoes would adversely affect the monument. Combined noise levels from Unser Boulevard, the expansion of the Double Eagle II Airport, proposed Paseo del Volcan, and proposed adjacent development could cumulatively and significantly increase noise levels in the monument. Mitigation measures regarding Unser Boulevard, the airport, and Paseo del Volcan would be developed with the Federal Aviation Administration, the state, and the city.

IMPACTS ON AIR QUALITY

Conclusion

Overall, the effects on air quality would be minor. No state or federal air quality standards would be exceeded. The emissions generated within the monument from the preferred alternative (and the other alternatives) would not exceed de minimus levels (100 tons per year for carbon monoxide) as described in the Environmental Protection Agency's general conformity regulations (section 176 [c] of the 1990 Clean Air Act amendments).

Temporary adverse impacts might occur during construction from dust, but they would not be significant.

Cumulative Impacts

Particulate matter (dust) from constructing proposed monument facilities combined with adjacent construction including Unser Boulevard, Double Eagle II airport, and Paseo del Volcan would have temporary adverse impacts on air quality. The use of adjacent roads and development and the airport would increase emissions.

IMPACTS OF IMPLEMENTING ALTERNATIVE 3

IMPACTS ON CULTURAL RESOURCES

Impact Analysis on Petroglyphs

No negative direct impacts of development on petroglyphs would be expected under alternative 3. The development of visitor facilities would establish a presence and help provide greater protection for petroglyphs. However, because there would be more visitor activities focused in Rinconada Canyon, the geologic windows, and Mesa Prieta, and on the mesa top, negative indirect impacts on petroglyphs could be expected. Petroleum products from vehicles on the mesa could have as yet undetermined effects on petroglyphs.

On one hand, the projected slightly higher visitation and the location of the visitor center in one of the most dramatic petroglyph concentrations of the monument would increase the number of people who would be exposed to the interpretive messages about the monument's significance and values. This awareness would help to protect the petroglyphs from damage and vandalism by visitors. Conversely, increased visitation and access would increase the potential for accidental damage to petroglyphs and other archeological sites. The location of major facilities in primary resource areas (the visitor center in Rinconada Canyon and the loop road on the mesa top) would provide easy access to important resources of high interest to visitors, but it would be more difficult to explain the significance and values of the monument because major facilities would be placed in primary resource areas.

The petroglyph research center would promote research regarding and public education and appreciation of the petroglyphs. Resource management and

center staff would develop ways to conserve the petroglyphs and repair vandalism. All of these actions would have positive impacts on petroglyphs.

Redesign of the trails and viewing areas at Boca Negra Canyon would have a positive effect upon the petroglyphs and their context by providing established viewing areas and by removing trails that wind through and between petroglyph concentrations or are too close to the features.

The increased activity levels at Homestead Circle park could increase the risk to the 50+ petroglyphs along the escarpment in this area. Petroglyphs would be easier to access and thus more likely to be destroyed through vandalism and inadvertent actions such as climbing.

Impact Analysis on Archeological Sites

The presence of the research center would reduce vandalism and illegal collecting in Piedras Marcadas Canyon and would provide for new dimensions in public education. Constructing paved roads, multiuse trails, and other visitor facilities could directly impact sites, especially considering the larger scope of the development in this area when compared to the other alternatives.

Increased numbers and mobility of visitors on the mesa top and elsewhere would increase risks for relic hunting, vandalism, and destruction of archeological sites, including long-term continued loss of surface artifacts.

Creating horse tie-ups and multiuse trails in the northern section of the monument would increase the possibility of damage to cultural resources by horses straying off

the trail and trampling sites, grazing, and rubbing on rocks. Negative impacts might also occur from bicyclists straying off the trail. Both activities create a churning effect that destroys soil strata and displaces and breaks artifacts. Designation of trails would focus horseback and bicycle riding activities and help protect archeological sites from illegal collecting and site disturbance. Frequent monitoring of areas along the trails and enforcement of regulations and other protective measures in areas where straying is apparent would reduce potential for negative impacts on sites.

Sites in the geologic windows would also be at risk for vandalism and relic hunting because they are separate from the rest of the monument and visitors would have unrestricted access, which would make the windows more difficult to manage and protect.

The management of visitors as described in this alternative would help mitigate the negative impacts of concentrated use in selected areas and damage from looting and vandalism. However, some vandalism and loss of archeological materials would likely continue.

Reclaiming abandoned mine sites could potentially impact unknown archeological resources.

See the following table for a summary of suggested effects, mitigation, and further compliance needed.

Impact Analysis on the Cultural Landscape

Facilities would intrude on the cultural landscape and compromise its visual integrity, including those qualities of feeling, association, and setting that

contribute to its potential national register properties. Designing and locating facilities to minimize visual intrusion on the cultural landscape and to maintain those characteristics that make it significant would reduce the adverse impacts of development.

Constructing paved roads on the mesa top would adversely affect the cultural landscape by introducing visual intrusions and noise from vehicular activity. The west mesa, especially the volcanoes, has been identified as an area of spiritual significance, and roads would be an adverse impact on this resource. The presence of facilities, especially the mesa-top road and the visitor center in Rinconada Canyon, would intrude on the cultural landscape. Changes in vegetation patterns could result from modified drainage patterns as hard surfaces are introduced on the mesa. Although sensitive design and management strategies would reduce these adverse impacts on the cultural landscape, there would be no way to avoid them entirely.

Conclusion of Impacts on Cultural Resources

Developing a road on the mesa top would adversely impact the cultural landscape and its significance to the Pueblo community. This alternative would directly impact more archeological sites and would require more costly programs to mitigate than any of the other alternatives. Identification and evaluation of resources, sensitive design, and appropriate mitigating measures would minimize impacts on archeological sites during and after facility development. There would be some adverse effects on cultural resources. There would also be a greater risk for long-term loss of cultural resources under this alternative.

TABLE 18. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 3 ON CULTURAL RESOURCES LISTED ON OR ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES, PROPOSED PROTECTIVE MEASURES, AND REQUIRED COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT.

Note: The entire monument, Boca Negra Cave, Las Imagines Archeological District, and the Piedras Marcadas Pueblo ruin are all listed on the national register. Cultural resources include cultural landscape, archeological and

ethnographic sites, and petroglyphs. Unless otherwise noted in the following table, construction could probably avoid sites.

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Rinconada Canyon — See alternative 1 for sites in vicinity of visitor center and heritage education facility. Other sites in canyon too numerous to mention.	Build visitor center and heritage education facility, parking, rest-rooms, access roads, and pedestrian trails.	With mitigation, most proposed activities would have no adverse effect. Intensive use of area might have adverse impacts on resources.	• Design facilities to avoid cultural sites or intrusion upon cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage.) • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor and student use. • Conduct archeological investigations, collect artifacts, and document and stabilize sites and surface features in areas adjacent to facilities and where intensive use is proposed.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Piedras Marcadas Pueblo Ruin	Develop interpretive trail; remove existing building.	With mitigation, no adverse effect.	• Continued consultation with Pueblos. • Develop ruins management plan in consultation with Pueblo community, SHPO, and ACHP. • Collect, document, and stabilize to prevent erosion. • Develop mitigation plan with SHPO. • Design visitor facilities to avoid pueblo ruins or intrusion on cultural landscape and to prevent impacts from visitor use. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use. • Fence and patrol site.	SHPO/ACHP consultation in preparing preliminary design, mitigation plan, and ruins management plan.

TABLE 18. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 3 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Mesa Prieta — See alternative 1 for description of sites in proposed development area and along 98th street access road. Sites on mesa top in vicinity of proposed roads too numerous to list, ranging from Archaic period to present. Also, potential cultural landscape, ethnographic sites.	Build visitor contact facility, parking, restrooms, access road, trails.	• With mitigation, no adverse effect from construction or visitor use. • Adverse effect on cultural landscape from mesa-top road and traffic.	• Design facilities to avoid cultural sites and minimize intrusion on cultural landscape. • Design roads to prevent impacts from visitor use (e.g., informal pullouts, overlooks adjacent to sites, etc.). • Develop mitigation plan with SHPO. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitation.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Piedras Marcadas Canyon — Three sites in vicinity (two PIII-PIV lithic-ceramic scatter and water control features; historic campsite). Petroglyphs, potential cultural landscape.	Construct petroglyph research center, parking, restrooms, pedestrian trails.	• With mitigation, no adverse effect. • Presence of center would deter vandalism.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use. • Permits would be required.	Same as above.
Boca Negra — Six adjacent sites include 1 stone circle, (age unknown); 4 water and soil control structures; 1 historic shelter. Vicinity: petroglyphs, potential cultural landscape.	Construct visitor information kiosk, improved trails, parking, access road, restrooms.	• With mitigation, no adverse effect. • Positive effect on petroglyphs by rebuilding inadequate trail system (helps to prevent impacts from visitor use).	Same as described for Rinconada Canyon (above).	Same as above.

TABLE 18. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 3 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Lava Shadows — No known resources in immediate area of existing structures.	Construct structure for administration; raze existing structures.	With mitigation, no adverse effect.	Presence of administrative facility would help prevent unauthorized access to cultural sites in vicinity.	No action.
Volcanoes — Volcanoes are sensitive ethnographic resources; four prehistoric sites nearby include petroglyphs, rock shelter, lithic/ceramic scatters, and/or grinding stone; three historic sites include corrals, pre- and post-WWII historic debris, lambing pens, hearth and/or corral; one site has corral and lambing pen, rock shelter and lithic/ceramic scatters. Vicinity: potential cultural landscape, ethnographic sites.	• Construct parking, access road, visitor information, improved trails, rest-rooms, picnic facilities, overlook. • Reclaim cinder mining sites.	• With mitigation no adverse effects. Parking area previously impacted. • Limiting public access to other volcanoes would be beneficial to values held by culturally affiliated groups. • The reclamation of cinder mines would not occur if adverse impact on values of these groups would occur.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use. • Conduct archeological investigations, collect artifacts, and document and stabilize sites and surface features in areas adjacent to facilities and where intensive use is proposed. • When rehabilitating facilities, use care to avoid disturbance of unknown subsurface remains. • Consult with American Indians to ensure no traditionally gathered resources are disturbed. • Develop memorandum of agreement with SHPO, ACHP, and Pueblos regarding development impact on ethnographic landscape values and sites.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.

TABLE 18. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 3 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Geologic Windows — 13 sites in vicinity of proposed trails (prehistoric petroglyphs and rock features, windbreak; historic corrals, structures, shelter, and walls). Potential cultural landscape.	Rehab existing access roads; construct parking and trails.	Potential adverse effect on resources at geologic windows.	• Design facilities to avoid cultural sites or intrusion on cultural landscape. • Design trails to reduce impacts from visitor use (construction and use of formal trails protects resources from inadvertent damage). • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Establish monitoring and response plan. • Increase educational programs and law enforcement to prevent impacts of visitor use.	SHPO/ACHP consultation in preparing preliminary design and mitigation plan.
Mesa Top — Sites too numerous to mention, ranging from Archaic period to present, many different activities land uses represented.	• Construct scenic drive, multiuse trails, picnic areas, overlooks. • Rehabilitate and revegetate existing roads and selected trails.	• Adverse effect of road, traffic on ethnographic values and cultural landscape. • Possible adverse impacts on archeological sites.	• See proposed protective measures for volcanoes. • Develop memorandum of agreement with SHPO, ACHP, and Pueblos regarding development impact on ethnographic landscape values and sites.	Same as above.
Neighborhood Access — Several adjacent sites, including lithic/ceramic scatters. Vicinity: petroglyphs, potential cultural landscape.	Construct neighborhood access points and trails.	With mitigation, no adverse effect.	Same as geologic windows (above).	Same as above.
Escarpment Crossings, Calle Norteña and Boca Negra — Four sites in vicinity: one prehistoric lithic reduction site (Calle Norteña); prehistoric shelter, Anasazi water and soil control walls and terraces (Boca Negra).	Develop multiuse trails crossing escarpment.	With mitigation, no adverse effect.	• Sites would be avoided. • Design escarpment crossing trail to reduce impacts from visitor use (the construction and use of formal trails would protect resources from inadvertent damage).	None unless resources were found.

TABLE 18. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 3 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Homestead Circle, Taylor Ranch Road/Calle Norteña Area — One prehistoric site (lithic/ceramic scatter) in vicinity. Petroglyphs.	• Develop Homestead Circle park as neighborhood park. • Develop trail for access as in alternative 1. • Regrade and revegetate disturbed area near Taylor Ranch Road/Calle Norteña.	No effect of development, but increased risk to adjacent petroglyphs from proximity to park.	• No known resources in proposed development areas. • Site-specific surveys would be conducted as appropriate before development. • Increase public education and patrols.	SHPO/ACHP review of project if resources are discovered.

Cumulative Impacts on Cultural Resources

The extent and type of visitor use and facilities provided for in this alternative would be similar to alternative 1 but would result in more adverse cumulative impacts under this alternative than under any other alternative.

There would be impacts on cultural resources by the city's construction and use of Unser Boulevard through the escarpment and the removal of the existing road and the construction of the recreational trail and utility corridor through Boca Negra Canyon. These impacts would be mitigated by minimizing the rights-of-way and disturbed areas required for the routes, using construction techniques that would not disturb adjacent basalt and petroglyphs, and using design and materials to minimize noise and visual intrusion.

IMPACTS ON VALUES HELD BY CULTURALLY AFFILIATED GROUPS

Facility construction and continuing intrusion by visitors and automobiles

would have a negative impact on the monument area's spiritual values to the Pueblo Indians. Because easy access is provided to the volcanoes, the opportunity for unauthorized use of these ethnographically important features would increase. Because of the increased use and road development, it would be more difficult to ensure privacy for affiliated groups and religious activities and they would be adversely affected.

Developing Piedras Marcadas Pueblo ruin only after special study and consultation with concerned Pueblos would avoid impacts related to intrusion on sacred and significant areas and human remains and artifacts. Consultation would result in further participation and involvement by culturally affiliated groups in monument interpretive and resource protection programs.

If reclaiming abandoned mine sites would adversely impact areas of spiritual significance to the Pueblo community, reclamation would not occur in those areas.

Conclusion

There might be positive impacts on the values held by these groups through participation in consultation regarding site protection and interpretation. There would also be negative impacts because of the development, especially on the mesa top.

Cumulative Impacts

The development of mesa-top roads and trails and intensified public use of this area would limit the areas that might be suitable for Pueblo groups to practice their religious activities, reduce the quality of their religious experiences, contribute to degradation of sites, and make privacy much more difficult to achieve.

The city's construction of Unser Boulevard by the city through the escarpment is opposed by American Indian groups and the Atrisco heirs. There would be adverse impacts on these groups and their ability to maintain their connection to the monument.

IMPACTS ON FEDERAL AND STATE THREATENED ENDANGERED SPECIES

Impact Analysis on Plants

Facility development in the monument would adversely impact 50 acres of potential habitat for the *Pediocactus paprycanthus* and *Mammillaria wrightii*. Bicycle and horse activity in the northern portion could also further adversely impact this habitat because of greater potential for off-trail use and trampling.

Conclusion. Although 50 acres represent 1% of total available habitat, this alternative would impact more potential habitat for the *Pediocactus paprycanthus* and the *Mammillaria wrightii* than in the other

alternatives, and the impacts would result in a significant adverse effect.

Cumulative Impacts. The destruction of potential habitat for these cactus species could eliminate the opportunity for this species to populate the area and thus could contribute to the overall decline of these species.

As in alternative 1, conducting site-specific surveys before the city's construction of Unser Boulevard and the recreation trail and utility corridor would ensure that no threatened or endangered species were present.

Impact Analysis on Birds

Development in the monument would adversely impact the ferruginous hawk. A 10-mile road and associated visitor activity would provide enough disturbance to eliminate the bird as a breeding species in this area.

Conclusion. Development in the monument would have a significant adverse affect on the ferruginous hawk. It would be eliminated from the area as a breeding species.

Cumulative Impacts. Developing certain sites, combined with adjacent development and the city's construction of Unser, would eliminate the hawk as a breeding species in this area would contribute to the overall decline of the ferruginous hawk nationwide.

As in alternative 1, site-specific surveys should be conducted before the city's construction of Unser Boulevard to ensure that no threatened or endangered species were present.

IMPACTS ON WILDLIFE OTHER THAN LISTED SPECIES

Impact Analysis on Birds

Impacts from developing visitor facilities would be much the same as discussed under the proposed action. Development below the escarpment would adversely impact 16.5 acres of habitat. This would be an adverse effect, but it would not be significant.

Additionally, developing a 10-mile paved road on the mesa top would adversely impact habitat for many bird species — more than in any of the other alternatives. As land is developed adjacent to the monument, bird populations would attempt to move to monument lands. The extent of development under this alternative would discourage that process.

Impact Analysis on Other Wildlife

Constructing a 10-mile loop road and 7 miles of multipurpose trails on top of the mesa would adversely impact 60 acres of habitat that supports coyote, rabbits, foxes, and rodents. Road kills would be increased. Some populations might decrease due to the increased presence of people and motorized vehicles in an area that currently has no paved roads. Detailed wildlife surveys have not been conducted on the mesa top; however, roads have been known to fragment habitat and populations in other areas. Some species are not likely to cross roads, thus roads become a barrier and gene pools are impacted. Population decreases would occur as species leave the monument due to the disturbance from road and visitor activity. Homestead Circle park development would eliminate small mammal habitat and adversely affect 3 acres of native wildlife habitat.

Conclusion. Approximately 78 acres of wildlife habitat would be developed. Most impacts on wildlife from development and visitor activity would occur in the flat lands and equal 16.5 acres of impact. This represents 1% of the total available habitat in the monument. Adverse impacts on birds and other wildlife would be significant under this alternative.

Cumulative Impacts. Facility development combined with adjacent development and the city's construction/extension of Unser Boulevard would impact wildlife species by destroying habitat. The cumulative impacts on birds and other wildlife would be greatest under this alternative.

IMPACTS ON NATURAL DRAINAGE PATTERNS AND FEATURES

Impact Analysis

Five arroyos would be crossed by the road, requiring bridges and culverts. The construction of the road would change the natural drainage patterns on the mesa, causing more sheet flow from 103,250 square yards of pavement. Depending on road construction methods, sheet flow might be directed into these arroyos, increasing erosion and deposition of sediment downstream. A drainage management plan would have to be developed to address stormwater flows resulting from road development.

Erosion from rainfall would continue on the mesa top. Arroyos would continue to enlarge and get smaller, depending on the amount of water and sediment they would carry during storms. Flooding would continue, creating new channels and erosion of the escarpment edge.

Conclusion

Constructing and hardening 78 acres of parking areas, roads, trails, and facilities would increase stormwater flows in the monument. Establishing designated trails to gain access to the mesa top and restoring existing roads and trails on the mesa top would slow current erosion and gully formation. However, the level of development would not be a beneficial effect on monument vegetation and soils. About 50 acres of disturbed land would be restored throughout the monument, decreasing gully activity and erosion.

Flows would be diverted into holding structures or other stormwater management methods that would decrease potential for erosion and gulying but would not eliminate these actions during storms. The increased development and stormwater flow from the monument means that storms would have more serious impacts on the monument's natural drainage patterns and features than under the other alternatives.

Cumulative Impacts

The cumulative impacts would be similar to alternative 1 but greater because of the extent of road construction in the monument. The construction of monument facilities and, in addition, the development of adjacent properties and the construction of Unser Boulevard by the city would have impacts on natural drainage patterns and features. There would be adverse impacts on natural drainage patterns within the new Unser Boulevard alignment. Positive impacts from extending Unser Boulevard would include the removal of a 1,000-foot trench that is outside the monument, which directs stormwater flows from Paradise Hills into Piedras Marcadas Canyon. Other positive impacts would be providing an opportunity to manage

stormwater flows in a manner that would not adversely affect monument resources.

IMPACTS ON BIODIVERSITY

Impact Analysis

Constructing a road on the mesa top might fragment existing habitat and serve as a barrier to some species. Fragmenting habitat and eliminating species interaction adversely impacts biodiversity and gene pools within species. Populations decline either through death or displacement thus having further adverse impact on biodiversity. This alternative develops more land, 78 acres, than the other alternatives. The development of 78 acres might proportionally decrease wildlife species and plant species. Due to the high rate of development occurring adjacent to the monument, the monument might serve as an area where species would move to if habitat exists to support them. In this alternative, less species might move to monument lands due to the level of development in the monument.

Horse use on the mesa top would adversely affect biodiversity by the introduction and spread of exotic plants. However, most of the monument has been previously disturbed by heavy grazing, and many of the prominent plants are exotic species. This would not be a significant impact.

Developing an active recreation park at Homestead Circle would introduce exotic species, fertilizers, and possibly herbicides and pesticides into the monument. There would be negative impacts on biodiversity.

Reclaiming 10 acres of mined area at the volcanoes would restore habitat and contribute to the monument's biodiversity. Closing a large portion of the volcanoes would also contribute to biodiversity, as

would reclaiming 50 acres of various trails, roads, and other disturbed areas.

Conclusion

The development of 78 acres in the monument out of a total of 7,244 acres represents 1.0% of the total habitat available. This would be a significant adverse impact. However, this would be mitigated by restoring 50 acres of disturbed land.

Cumulative Impacts

Development in the monument would have a adverse cumulative impact on biodiversity in the monument because of species displacement that would occur because of monument development and adjacent land development. However, there would be some cumulative benefits of restoring habitat.

The city's construction of Unser Boulevard might have adverse impacts on biodiversity by eliminating habitat, increasing noise levels, and preventing some wildlife movement.

The monument is likely to become an isolated island of habitat that over time would have a significant adverse impact on biodiversity.

IMPACTS ON SOILS

Impact Analysis

The following table shows impacts by soil type and at development areas to provide a more complete and understandable picture of the impacts on soils. Impacts can be seen by looking at the "Soil Characteristics/Impacts" column on table 13. For example, soils with moderate to high

potential for erosion (by wind or water) would be impacted by development and vegetation removal more than soils with slight to moderate potential for erosion.

During road construction, requirements such as watering and immediate revegetation efforts would mitigate adverse impacts on these soils. Constructing new access to volcanoes and revegetating existing roads would not adversely affect soils because there would be no net loss.

Runoff from the paved road would contaminate soils. Typically roadways accumulate deposits of oil and other petroleum-based products. These products would migrate into the soil in stormwater runoff. This would be an adverse impact on soils.

Keeping visitors only on established trails would prevent further erosion, vegetation removal, and compaction, which all result in adverse impacts on soils.

Conclusion

Facility development on about 78 acres of soils within the monument would result in an adverse impact on soils. This is important because soils support plant and wildlife habitat and contribute to the health of the west mesa ecosystem.

Restoring mining sites, the volcanoes, Calle Norteña, and other disturbed areas (about 50 acres) would be a beneficial impact, stabilizing soils that are currently subject to erosion.

Cumulative Impacts

Facility development combined with adjacent development, including Unser Boulevard would cumulatively adversely impact soils.

TABLE 19. SOIL IMPACTS BY DEVELOPED AREA, ALTERNATIVE 3

Developed Area	Acres of Moderate to Highly Erodible Soils Affected
Rinconada Canyon	Bluepoint-Kokan, hilly; Bluepoint loamy fine sand, 1-9% slopes
Piedras Marcadas Canyon (including trails)	Alemeda sandy loam, 0-5% slopes; Bluepoint loamy fine sand, 1-9% slopes
Lava Shadows	Madurez-Wink, gently sloping; Bluepoint-Kokan, hilly
Boca Negra Canyon	Bluepoint-Kokan, hilly
Volcanoes area	Akela-Rock outcrop, 1-9% slopes; Alemeda sandy loam, 0-5% slopes; Rock outcrop-Akela, 10-50% slopes Continued visitor access to Vulcan would continue erosion of the shallow talus soils and have an adverse impact on these soils.
Piedras Marcadas ruin area	Bluepoint-Kokan, hilly
Homestead Circle park	Bluepoint-Kokan, hilly
Mesa Prieta	Bluepoint-Kokan, hilly; Bluepoint loamy fine sand, 1-9% slopes
Mesa top trails	Madurez-Wink, gently sloping; Alemeda sandy loam, 0-5% slopes; Akela-Rock outcrop, 1-9% slopes
Neighborhood access trails	Bluepoint-Kokan, hilly; Kokan Rock outcrop; Alemeda sandy loam, 0-5% slopes; Bluepoint loamy fine sand, 1-9% slopes
Windows	Kokan-Rock outcrop; Alemeda sandy loam, 0-5%; Akela Rock outcrop
10-mile mesa-top loop road	Alemeda sandy loam, 0-5% slopes; Madurez-Wink, gently sloping; Rock outcrop-Akela, 10-50% slopes

IMPACTS ON SCENIC RESOURCES

Impact Analysis

Developing a 10-mile loop road on the mesa top would affect views from Black Volcano, I-25, and from the new Unser alignment. The road proposed in this alternative would fundamentally change the scene of the mesa top from a primarily natural scene to a scene eclipsed by a major development and many cars circulating on the mesa top. Although the road would provide access to views of the city, the Sandia Mountains, and the general character of the mesa, it would adversely impact the views of the mesa from all directions.

Developing a visitor center at Rinconada Canyon would adversely impact an

important natural scene of the monument. The canyon would be the primary location where the escarpment could be seen in its natural setting from Unser, the principal visitor access route through the monument. As development occurs adjacent to the monument boundary and disrupts views of the escarpment, this view would become increasingly important.

Homestead Circle park and playground development would change the scenic quality at this location by using nonnative turf and playground structures, which would be inconsistent with the native vegetation and architectural style of the structures of the rest of the monument. This action would relate Homestead Circle more closely with the neighboring suburban development, and it would lose its visual connection to the monument,

thus resulting in an adverse impact on visual quality.

Mesa-top drainage facilities would have significant visual impacts.

Other proposed actions of this alternative would result in the same visual quality impacts as alternative 1.

Conclusion

The visual quality of the monument would be permanently changed and be adversely impacted by developing facilities on the mesa top, at Rinconada Canyon, and from adjacent development.

Cumulative Impacts

Developing a road on the mesa, locating the visitor center at Rinconada, and developing Homestead Circle park as a neighborhood park would contribute to the increasing suburban development of the west mesa area and prevent the preservation of expansive or important natural views. Other actions of this alternative combined with adjacent development, the Unser Boulevard extension by the city would have the same cumulative impacts as alternative 1, but they would be greater because of the extent of the monument road.

IMPACTS ON THE LOCAL AND REGIONAL ECONOMY

Impact Analysis

The analysis provided for alternative 1 also applies for alternative 3. The monument would be developed, but in a somewhat

different manner. Differences in positive economic impacts between alternatives would be expected but cannot be quantified.

Conclusion

Monument establishment and development has had and will continue to provide positive economic benefits for the Albuquerque area. Although the direct economic benefits might be relatively small in relation to the entire economy of the region, they are significant. Even more significant might be the unquantifiable positive benefits that accrue to the region due to the monument's existence and development and the quality of life values it provides and protects.

Cumulative Impacts

Petroglyph National Monument is an economic plus for the city and would become a premier attraction of the city and the region. The development of the monument would lead to increased visitor use of the monument and increased tourism in the city and area. Thus, positive economic benefits would accrue to the local economy.

The city's construction of Unser Boulevard the recreational trail and the utility corridor would benefit the local and regional economy by facilitating traffic flow, reducing traffic congestion on other roads, allowing for enjoyment of monument resources, and providing utilities to the mesa top. However, because of the need to minimize impacts on monument resources, there would be increased design and construction costs.

IMPACTS ON NATIONAL VISITORS

Impact Analysis

Developing a 10-mile loop road on the mesa top would not provide an experience for the visitor that is vastly different than what is provided by the 81st Street extension and overlook described under the proposed action. It would provide driving experience on the mesa top that allows visitors to drive from the escarpment to the volcanoes on a monument road. Similar mesa-top driving experiences are achieved by driving I-40, 81st Street, and the Double Eagle II access road. Views of Albuquerque provided by this road are also provided from 9-mile hill on I-40 and from the summit of the Sandias.

The 10-mile loop road would provide monument visitors with an experience similar to what is obtained in other NPS areas in which a closed loop road is provided for visitors to enjoy the monument. However, visitors would not be able to see petroglyphs along this road, because most of the petroglyphs are along the base of the escarpment.

Developing a visitor center in Rinconada Canyon would provide visitors with a dramatic entrance to the monument, close to the interstate. Sufficient orientation and interpretation would occur to introduce visitors to the monument and its resources. Petroglyphs would be within easy walking distance for all visitors and abilities, thus providing immediate interpretive opportunities.

Developing a visitor contact facility and entrance station at Mesa Prieta would also provide visitors with a dramatic experience soon after they leave the interstate. Visitors would walk along the base of the escarpment on a designated trail to petroglyph viewing areas.

Developing the visitor center and driving route in the southern portion of the monument would effectively concentrate and focus visitor activity in this area rather than spreading it throughout the monument. Only those visitors with more time or who expressed specific interest would be directed to Piedras Marcadas and Boca Negra Canyons. These areas would have the impression of remaining the most isolated and undeveloped; however, both would be surrounded by neighborhood development.

Combined use of trails by visitors and educational groups in high-use areas would lead to congestion and seriously diminish the experience for both groups.

Noise levels from development near the Piedras Marcadas Pueblo ruin would increase and adversely affect the site and visitors. Because of the level of development in this alternative, there would be few opportunities for solitude.

Conclusion

It is likely that the relatively high level of development and resulting visitor use would be inconsistent with Pueblo Indian and Atrisco land grant heirs' views of the monument. Thus it would be expected that there would be no support or participation from these groups in managing and interpreting the monument. Opportunities to interpret these cultures' views would be lost, resulting in an adverse affect on visitors.

Cumulative Impacts

More visitors would have easy access to primary monument resources such as Rinconada Canyon and the mesa top. The only place for visitors who have come to the monument in the past for a sense of

solitude would be Piedras Marcadas Canyon or to more remote federal lands in other portions of the state.

The construction of Unser Boulevard and the recreational trail by the city would benefit national visitors by facilitating access to the mesa top by vehicles, bicycles, horseback, and foot. There would also be a beneficial impact of eliminating vehicular traffic in Boca Negra Canyon. There would be adverse impacts on visitors by the visual intrusion, increased noise levels, and the barrier of the four-lane highway. Creative design and material use would minimize these impacts.

IMPACTS ON LOCAL VISITORS AND ADJACENT LANDOWNERS

Impact Analysis

Implementing this alternative would, better than the other alternatives, separate national and local visitors from each other by focusing national visitors in the southern portion. Piedras Marcadas and Boca Negra Canyons would likely accommodate more local residents who visit the monument on a more regular basis.

Constructing a 10-mile loop road would adversely impact those horseback riders and bicyclists who use the mesa top for a wide open space, free from urban development. Some might use the shoulders of the road.

Constructing a visitor center and heritage education center in Rinconada Canyon would decrease visitor traffic through neighborhoods that would likely have increased traffic in the other alternatives. Developing a petroglyph research center at Piedras Marcadas Canyon would not likely adversely impact local residents.

Constructing neighborhood access points would have a positive impact on adjacent landowners, providing them with easy access to the monument and protecting the escarpment from the creation of social trails.

Developing Homestead Circle park as an active recreation area with turf and playground equipment would benefit neighborhood residents because of the limited opportunities for these activities in the area.

Local residents and adjacent landowners might be adversely affected by the requirement to obtain a permit before entering Piedras Marcadas Canyon, but they might also appreciate the benefits afforded by the use of permits.

Noise levels from development near the Piedras Marcadas Pueblo ruin would increase and adversely affect the site and visitors.

Conclusion

This alternative would have a beneficial effect on the local visitor by providing greater separation of national and local visitor traffic and providing areas that would be more likely visited by local visitors. This might provide a feeling of greater stewardship for the area than exists today among residents.

Higher visitation levels could increase the values of nearby commercial properties. Other impacts would be the same as alternative 1. The primary visitor use areas at Rinconada Canyon and the mesa top would reduce the number of vehicles north of Rinconada Canyon on Unser Boulevard and have a beneficial impact on local residents and adjacent landowners.

Cumulative Impacts

The cumulative impacts would be similar to alternative 1 but greater because of the extent of monument facilities. The construction of Unser Boulevard, the recreational trail, and the utility corridor by the city would benefit adjacent landowners and local visitors by facilitating access and allowing enjoyment of monument resources. Adjacent landowners west of the escarpment, would also benefit from the utility access. There would be adverse impacts from visual and noise intrusions from traffic on Unser Boulevard, combined with the monument road. Creative design and material use would minimize these impacts.

IMPACTS ON ENERGY CONSUMPTION

Impact Analysis

Developing the mesa top road would significantly increase energy use and result in adverse impacts on energy conservation. Much energy would be used to construct, use, maintain, and patrol the road.

New facilities constructed at Lava Shadows would increase energy consumption to a minor degree. Other actions in this alternative would result in the same impacts as alternative 1.

Conclusion

New roads and facilities would result in adverse impacts on energy consumption.

Cumulative Impacts

The construction and vehicular use of the mesa-top road would contribute to increasing demands for energy in the area as surrounding suburban development continues to grow. Constructing new facilities at Lava Shadows would raise local energy use for new building materials and transportation to a minor degree. Energy conservation measures would mitigate much of the adverse energy consumption impacts.

IMPACTS OF MONUMENT USE AND ACTIVITIES ON EXISTING NOISE LEVELS

Impact Analysis

The greatest increase in noise levels would likely be at Mesa Prieta, the mesa top, the volcanoes, and Rinconada Canyon. Noise levels from construction would be temporary and not significant. Noise levels from operation in the above-mentioned areas would be increased significantly. Developments in this alternative would have a greater impact on noise levels than development in the other alternatives.

Conclusion

Developing and operating monument facilities would have a significant adverse impact on noise levels.

Cumulative Impacts

It is expected that noise from proposed adjacent development near Mesa Prieta, Boca Negra and Piedras Marcadas Canyons, the Piedras Marcadas Pueblo ruin, and the volcanoes would also adversely affect the monument. Combined with noise levels from Unser Boulevard, the expansion of the Double Eagle II Airport, proposed Paseo del Volcan, and proposed adjacent development could cumulatively and significantly increase noise levels in the monument to a greater degree than in the other alternatives. Mitigation measures regarding Unser Boulevard, the airport, and Paseo del Volcan would be developed with the Federal Aviation Administration, the state, and the city.

IMPACTS ON AIR QUALITY

Conclusion

Overall, the effects on air quality would be minor. No state or federal air quality

standards would be exceeded. The emissions generated within the monument from the preferred alternative (and the other alternatives) would not exceed de minimus levels (100 tons per year for carbon monoxide) as described in the Environmental Protection Agency's general conformity regulations (section 176 [c] of the 1990 Clean Air Act amendments). Temporary adverse impacts might occur during construction from dust, but they would not be significant.

Cumulative Impacts

Particulate matter (dust) from constructing proposed monument facilities combined with adjacent construction including Unser Boulevard, Double Eagle II airport, and Paseo del Volcan would have temporary adverse impacts on air quality. The use of adjacent roads and development and the airport would increase emissions.

IMPACTS OF IMPLEMENTING ALTERNATIVE 4 — NO ACTION

IMPACTS ON CULTURAL RESOURCES

Impact Analysis on Petroglyphs

Implementing the no-action alternative would increase the risk of loss of petroglyphs because of the lack of facilities and programs except at the Boca Negra unit. Existing trails would not be improved or changed, thus continuing adverse impacts on petroglyphs. In many areas, existing trails are directly adjacent to petroglyph panels. The location of the trail adjacent to the petroglyphs combined with the narrowness of the trail has the effect of encouraging visitors to touch the petroglyphs. Over time, there could be an adverse affect on the patina of rocks that outline the petroglyphs because of thousands of visitors touching or scratching the rock surfaces.

Also, existing trail alignments pass between petroglyph panels, allowing visitors to walk between them, thereby interrupting the understanding of possible relationships of panels in a concentrated area. Direct and indirect adverse impacts would occur on petroglyphs in Rinconada and Piedras Marcadas Canyons by providing parking but having limited interpretive information and resource protection staff.

The petroglyph research center would promote research regarding and public education and appreciation of the petroglyphs. Resource management and center staff would develop ways to conserve the petroglyphs and repair vandalism. All of these action would have positive impacts on petroglyphs. However, with less staff and funding, these gains would be less effective than in the other alternatives.

Impact Analysis on Archeological Sites

Fewer direct adverse impacts on archeological sites from construction would be anticipated than in the other alternatives. Because of minimal monitoring and regulation on the many existing horseback riding and bicycle trails, there would be greater risk of damage to the archeological resources. Horses straying off the existing trails could trample sites. Negative impacts might also occur from bicyclists straying off the trails. Both activities, if off the trail, create a churning effect that destroys soil strata and displaces and breaks artifacts. There is also greater risk of pot-hunting.

See the following table for a listing of the monument's prehistoric and historic properties, the rationale for affects to those properties, determinations of effect, and further section 106 compliance requirements.

Impact Analysis on the Cultural Landscape

Developing parking at Rinconada and Piedras Marcadas Canyons would have limited negative effects on the cultural landscape in these areas.

Conclusion of Impacts on Cultural Resources

Adverse impacts on petroglyphs, the cultural landscape, and archeological sites would occur. Under this alternative, resource deterioration and vandalism could occur due to lack of adequate funding, opportunities to educate the public, and programs to protect sites, including petroglyphs.

TABLE 20. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 4 ON CULTURAL RESOURCES LISTED ON OR ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES, PROPOSED PROTECTIVE MEASURES, AND REQUIRED COMPLIANCE WITH SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT.

Note: The entire monument, Boca Negra Cave, Las Imagines Archeological District, and the Piedras Marcadas Pueblo ruin are all listed on the national register. Cultural resources include cultural landscape, archeological and

ethnographic sites, and petroglyphs. Unless otherwise noted in the following table, construction could probably avoid sites.

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Lava Shadows — No known resources within immediate vicinity; potential cultural landscape, ethnographic sites in general vicinity.	Use existing visitor center, parking, roads, and trails.	No adverse effect.	Presence of monument staff, visitor center would help deter vandalism, resource degradation in vicinity.	SHPO/ACHP review of individual actions affecting significant cultural resources.
Boca Negra — Six adjacent sites include 1 stone circle (age unknown); 4 water and soil control structures; 1 historic shelter. Vicinity: petroglyphs, potential cultural landscape.	Parking, rest-rooms, continued heritage education function; minor trail improvement, and improved parking and shade structure.	• With mitigation, no adverse effect of construction. • Continued adverse affect on patina because of visitors touching rock surfaces.	• Areas receiving intensive use would be documented, artifacts collected, and surface resources stabilized. • Continued consultation with Pueblos. • Design trails to prevent impacts from visitor use.	Same as above.
Rinconada Canyon — Petroglyphs, archeological and ethnographic sites — too numerous to list. Potential cultural landscape.	Construct parking, access road, and trails.	• With mitigation, no adverse effect of construction. • Potential adverse effect of visitor use.	• Design trails and facilities to avoid cultural sites or intrusion upon cultural landscape, and to reduce potential for inadvertent damage from visitor use. • Develop mitigation plan with SHPO if cannot avoid sites during construction. • Continued consultation with Pueblos. • Include in monitoring and response plan. • Use educational programs and law enforcement to help prevent indirect impacts of visitation.	Same as above.

TABLE 20. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 4 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Piedras Marcadas Canyon — Petroglyphs and potential cultural landscape	Construct parking and access road.	With mitigation, no adverse effect. Potential adverse effect of visitor use.	• Locate parking to avoid intrusion upon cultural landscape and sites. • Use educational programs and law enforcement to help prevent indirect impacts of visitation. • Use fencing, patrols, visitor education to reduce indirect impacts of visitor use.	SHPO/ACHP review of individual actions affecting significant cultural resources.
Mesa Prieta — Petroglyphs, several prehistoric quarry sites, archeological sites ranging in age from Paleo-Indian times to present, historic livestock drive area, potential cultural landscape, ethnographic sites. See alternative 1 for more information.	No facilities; use existing trails.	With mitigation, no adverse effect of visitor use.	• Continued consultation with Pueblos. • Establish baseline monitoring plan to detect damage or deterioration of sites and petroglyphs.	Same as above.
Piedras Marcadas Pueblo Ruin	Conduct occasional tours.	With mitigation, no adverse effect.	• Stabilize any eroding areas. • Continue to inventory site resources. • See that informal trails do not impact buried resources. • Fence site and provide law enforcement.	Same as above.
Volcanoes — Volcanoes are sensitive ethnographic resources; four prehistoric sites nearby include petroglyphs, rock shelter, lithic/ceramic scatters, and/or grinding stone; three historic sites include corrals, pre- and post-WWII historic debris, lambing pens, hearth and/or corral; one site has corral and lambing pen, rock shelter and lithic/ceramic scatters. Vicinity: potential cultural landscape, ethnographic sites.	• Continue use of informal parking, access road, and trails. • No reclamation of cinder mine sites.	Potentially adverse impact of continued unauthorized use of volcanoes.	• Consult with Pueblos regarding operational methods of preserving sites, ethnographic values. • Use patrols, signing, and visitor education to help protect sites.	Same as above.
Geologic Windows — 13 sites in two areas.	No action.	Potential for adverse effect of unauthorized use.	Use fencing, patrols, and visitor education to reduce indirect impacts of visitor use.	Same as above.

TABLE 20. SUMMARY OF THE SUGGESTED EFFECTS OF ALTERNATIVE 4 (CONT.)

Area and Major Resource	Action	Proposed Determination of Effect	Proposed Protective Measures, Mitigation	Further 106 Compliance Requirements
Mesa Top — Mesa-top sites too numerous to list, ranging from Archaic period to present. Includes ethnographic resources and potential cultural landscape.	Continue to use multiuse and pedestrian trails.	With mitigation no adverse effect.	• Most trails follow existing informal roads. • Restrict use to trails. • Continued consultation with Pueblos.	SHPO/ACHP review of individual actions affecting significant cultural resources.
Neighborhood Access — Several adjacent sites, including lithic/ceramic scatters. Vicinity: petroglyphs, potential cultural landscape	Construct neighborhood access points and trails.	With mitigation, no adverse effect.	Same as Mesa Prieta. Trail construction would avoid sites.	Same as above.
Homestead Circle, Taylor Ranch Road/Calle Norteña Area — One prehistoric site (lithic/ceramic scatter) in vicinity	No action.	With mitigation, no adverse effect.	• Consult with Pueblos regarding operational methods of preserving sites, ethnographic values. • Use patrols, signing, and visitor education to help protect sites.	Same as above.

Cumulative Impacts on Cultural Resources

Over time, lack of staff and adequate funding and facilities to guide visitor use would contribute to loss of resources from vandalism, unauthorized collection, erosion of informal trails, theft of artifacts, and destruction of context by unmanaged horse and bicycle use. The cultural landscape and its values might also deteriorate because use would be less directed or managed than in the other alternatives. These lost resource values would be gradual but incremental and cumulative when combined with resource loss on other federal, state, and private lands.

There would be impacts on cultural resources by the city's construction and use of Unser Boulevard through the escarpment and possibly by the removal of the existing road and the construction of the recreational trail and utility corridor through Boca Negra Canyon. These

impacts would be mitigated by minimizing the rights-of-way and disturbed areas required for the routes, using construction techniques that would not disturb adjacent basalt and petroglyphs, and using design and materials to minimize noise and visual intrusion.

IMPACTS ON VALUES HELD BY CULTURALLY AFFILIATED GROUPS

Developing parking at Rinconada and near Piedras Marcadas Canyons would not have direct adverse impacts on values held by these groups. Lacking a major interpretive program to teach visitors respect for the spiritual values of traditional groups, more conflicts would arise between visitor use and groups practicing religious or traditional activities. Shrines and sacred areas might lose value because of inadvertent visitor use.

Conclusion

There might be positive impacts on the values held by these groups through participation in consultation regarding site protection and interpretation. Values held by these groups might also be negatively impacted by uncontrolled visitor use and more potential for vandalism.

There would be less opportunity for visitor education and therefore increased risk of negative impacts on the spiritual values held by these groups.

Cumulative Impacts

If petroglyphs or archeological sites, features, and objects are destroyed or desecrated by vandals, or practitioners are not able to use a special area for traditional religious activities, that ritual might not be continued.

The construction of Unser Boulevard by the city through the monument escarpment is opposed by American Indian groups and the Atrisco heirs. There would be adverse impacts on these groups and their ability to maintain their connections to the monument. Impacts from facility development would be less severe than in alternative 1, however impacts from unrestricted horse and bicycle use would continue.

IMPACTS ON FEDERAL AND STATE THREATENED AND ENDANGERED SPECIES

Impact Analysis on Plants

Implementing the no-action alternative would adversely impact 8.5 acres of potential habitat for the *Pediocactus papyracanthus* and *Mammillaria wrightii* cacti. Bicycle and horse activity would

have greater impact on this potential habitat than under the proposed action because permits would not be required and it would be more difficult to monitor and manage activities.

Conclusion. The 8.5 acres of potential habitat disturbance represents 0.30% of total potential habitat available. This would not be significant.

Cumulative Impacts. Development actions under this alternative could contribute to the extinction of the *Pediocactus papyracanthus* and *Mammillaria wrightii*.

It is not anticipated that there would be any adverse impacts on threatened or endangered plant species by the city's construction/extension of Unser Boulevard or the development of the recreational trail and utility corridor in Boca Negra Canyon because these routes are in areas that have been previously disturbed. Site-specific surveys must be conducted before construction to ensure that no threatened or endangered species were present.

Impact Analysis on Birds

It is anticipated that there would likely be no adverse effects on the ferruginous hawk from actions proposed in this alternative. However, the hawk might be adversely affected by development adjacent to the monument.

Conclusion. Development would not adversely affect the ferruginous hawk. Development actions would not contribute to the nationwide decline of this species.

Cumulative Impacts. Without mitigation, facility development under this alternative, combined with the development of lands outside the monument by the private sector and Unser Boulevard by the city,

could incrementally increase the amount and severity of the impacts on this species and could contribute to the elimination of the hawk as a breeding species in this area. These impacts, however, would be less severe than for implementation of alternative 1. With mitigation, there would be no significant adverse cumulative impacts on the hawk.

IMPACTS ON WILDLIFE OTHER THAN LISTED SPECIES

Impact Analysis

Trails that are shown on the Alternative 4 map are ones that currently exist. Minor trail improvements would be made to control erosion and prevent further widening, but no new trails would be developed. Therefore no additional adverse impacts on wildlife would be anticipated. Constructing parking areas would not have a significant impact on wildlife. About 4 acres of habitat would be eliminated. This would not have any significant adverse impacts on wildlife. Adverse impacts on 8 acres of flat land habitat would impact the crissal thrasher, sage sparrow, and loggerhead shrike. This would not be a significant impact. The monument would continue to have a beneficial impact on wildlife species on adjacent lands as their current habitat is developed.

If the former surface mine areas remain in their existing condition, the recovery of vegetation to conditions found in the surrounding lands might take several decades or centuries.

Conclusion

No significant adverse impacts on wildlife would occur as a result of implementing the no-action alternative.

Cumulative Impacts

Over time, increased visitor use of the monument without the use of permits and resource monitoring could result in more off-trail use, which would adversely impact wildlife species.

Monument facility and trail development combined with the city's constructing of Unser Boulevard and adjacent development would cumulatively impact birds and other wildlife species by destroying habitat and creating a barrier to movement by some wildlife; however, these impacts would be slightly less than alternative 1 due to the limited monument facility development proposed under this alternative.

IMPACTS ON NATURAL DRAINAGE PATTERNS AND FEATURES

Impact Analysis

Erosion from rainfall would continue on the mesa top. Arroyos would continue to enlarge and get smaller, depending on the amount of water they would carry during storms. It is likely that new erosional cuts would be created during storms where water cuts over the top of the escarpment. Only a small portion of disturbed land would be restored and revegetated, allowing continuing gully activity and erosion. Without adequate staffing to patrol all areas of the monument, social trails would be more likely to occur under this alternative, increasing erosion and gully activity.

Conclusion

Current erosion and gully activity would continue on the mesa top and along the escarpment. Stormwater drainage from

the monument would increase, but not significantly.

Cumulative Impacts

The construction of monument facilities and, in addition, the development of adjacent properties and the construction of Unser Boulevard by the city would have impacts on natural drainage patterns and features. However, these impacts would be less than described in alternative 1 because of the limited extent of monument facilities proposed. There would be adverse impacts on natural drainage patterns within the new Unser Boulevard alignment. Positive impacts from extending Unser Boulevard would include the removal of a 1,000-foot trench that is outside the monument, which directs stormwater flows from Paradise Hills into Piedras Marcadas Canyon. Other positive impacts would be providing an opportunity to manage stormwater flows in a manner that would not adversely affect monument resources.

IMPACTS ON BIODIVERSITY

Impact Analysis

The presence of large numbers of visitors in the monument, without available staff to ensure that all visitors are staying on trails, would increase the likelihood for creation of social trails and might displace some species of wildlife, though this would not be anticipated to be significant. Developing a total of 2 acres (0.02% of the total habitat available) would decrease wildlife and plant species and adversely impact biodiversity, but this would be insignificant.

Under this alternative 22 acres (0.3 % of the total habitat) would be developed. However, most of this development (18 acres) would occur on previously

disturbed land. This would not be a significant adverse impact on biodiversity. A small amount of disturbed land (20 acres) would be reclaimed.

Continued horse use in the monument would adversely affect biodiversity by the introduction and spread of exotic plants. However, most of the monument has been previously disturbed by heavy grazing and many of the prominent plants are exotic species. This would not be a significant impact.

Conclusion

No significant adverse impacts on biodiversity would be expected as a result of implementing the no-action alternative. This alternative would have the least beneficial effects on biodiversity.

Cumulative Impacts

Due to the high rate of development occurring adjacent to the monument and the construction of Unser Boulevard, less habitat would remain for wildlife species, thus displacing them onto the monument lands and associated open space lands.

The monument is likely to become an isolated island of habitat surrounded by development. This over time will have a significant adverse impact on biodiversity.

IMPACTS ON SOILS

Impact Analysis

The following table shows impacts by soil type and at development areas to provide a more complete and understandable picture of the impacts on soils. Impacts can be seen by looking at the "Soil Characteristics/Impacts" column on table 13. For

TABLE 21. SOIL IMPACTS BY DEVELOPED AREA, ALTERNATIVE 4

Developed Area	Acres of Moderate to Highly Erodible Soils Affected
Rinconada Canyon	Bluepoint-Kokan, hilly; Bluepoint loamy fine sand, 1-9% slopes
Piedras Marcadas Canyon	Alemeda sandy loam; Bluepoint loamy fine sand, 1-9% slopes; Bluepoint-Kokan, hilly
Lava Shadows	none
Volcanoes area	Unrestricted visitor use would compact soils and increase erosion in this area.
Neighborhood access	Kokan-Rock outcrop; Bluepoint loamy fine sand, 1-9% slopes; Alemeda sandy loam, 0-5% slopes; Bluepoint-Kokan, hilly
Mesa Prieta	Bluepoint-Kokan, hilly; Bluepoint loamy fine sand, 1-9% slopes; Alemeda sandy loam, 0-5% slopes; Madurez-Wink, gently sloping

example, soils with moderate to high potential for erosion (by wind or water) would be impacted by development and vegetation removal more than soils with slight to moderate potential for erosion.

During construction, requirements such as watering and immediate revegetation efforts would mitigate adverse impacts on these soils.

Conclusion

Visitor use and facility development on about 22 acres of soils within the monument would result in a adverse impact on soils. Soils are important because they support plant and wildlife habitat and contribute to the health of the west mesa ecosystem. This would not be a significant impact because most of this development would occur on previously disturbed land.

After construction is complete, impacts on soils would include compaction from visitor use. Under this alternative there would likely be more off-trail use than in the other alternatives. Unless visitors remained on designated trails, adverse impacts on soils would occur from off-trail use. This could result in a significant adverse effect. This alternative would have

the least beneficial impacts on soils because only a small portion of disturbed and compacted soil would be reclaimed.

Cumulative Impacts

Facility development combined with adjacent development including Unser Boulevard would cumulatively adversely impact soils — not to the degree that they would be impacted in the other alternatives due to the limited facility development proposed in this alternative.

IMPACTS ON SCENIC RESOURCES

Impact Analysis

Scenic qualities of the monument would be less affected because there would be fewer buildings in the monument under this alternative. The main visual impression of the monument as the visitor enters the monument access points would be of existing roads and parking areas. The net gain in visual quality would not be increased from fewer buildings in this alternative. The adverse visual impacts of trail use would also be increased by allowing most of the existing roads scars on the mesa to be used for trail develop-

ment, and less area of the mesa top would be restored to its natural scenic character. However, these actions would result in minor adverse visual impacts on the monument. There could be a positive impact on visitors because most of the monument's natural scenic resources would not be disturbed by the development of new facilities.

There would be no improvements from mine reclamation or restoration of Homestead Circle park or Calle Norteña under this alternative.

Conclusion

No significant adverse impacts would result from the proposals of this alternative. Adjacent development would adversely affect the scenic quality of views from the monument.

Cumulative Impacts

Significant portions of the monument would be preserved in its natural scenic quality, contributing to local efforts to preserve the natural areas of the west mesa. This would result in beneficial, long-term visual improvements for the community.

Adjacent development and the construction of Unser Boulevard by the city would adversely affect scenic resources and views, but less so because fewer monument facilities would be developed.

IMPACTS ON THE LOCAL AND REGIONAL ECONOMY

Impact Analysis

Fewer facilities and a lack of development would prevent visitor use of the monument from reaching its highest potential. The monument would continue to serve primarily as a local resource and would not provide the level of service to visitors nor the level of resource protection consistent with the monument's purpose and significance. As a result, the monument would be less of a national and regional attraction than in the other alternatives.

Conclusion

The direct economic benefits would remain relatively small in relation to the entire economy of the region.

Cumulative Impacts

Although the monument is an addition to the many attractions found in the Albuquerque area, it would not become as important a visitor attraction. Therefore it would be less likely to provide an increase in the economic base for the local and regional economy.

The construction of Unser Boulevard, the recreational trail, and the utility corridor by the city would benefit the local and regional economy by facilitating traffic flow, reducing traffic congestion on other roads, providing recreation opportunities, and providing utilities to the mesa top. However, because of the need to minimize impacts on monument resources, there would be increased design and construction costs.

IMPACTS ON NATIONAL VISITORS

Implementation of the no-action alternative would provide visitors with a minimal experience. The existing visitor center would include some new, small exhibits, but would continue to function primarily as an orientation site. Access would be provided to petroglyph concentrations, and trails would be maintained only to prevent significant resource damage. Some personal interpretation would occur in these areas, but no facilities such as wayside exhibits, restrooms, and visitor contact stations would be constructed.

The absence of these facilities would adversely impact visitors' experiences of the monument and limit the ability of the monument managers to impress on the public the significance of this resource. Lack of staff would impact monument managers' abilities to effectively patrol the monument, thus there might be an increase in vandalism, which would adversely impact opportunities for visitors to see undamaged petroglyphs.

Vandalism would also likely increase because of the lack of appropriate facilities (a heritage education center) to teach schoolchildren and other organized groups about the significance and importance of the petroglyphs and their context. This would have an adverse impact on the experience of national visitors.

Interpretation of the area's spiritual qualities would be more difficult given the type of visitor experience provided and the level of development throughout the monument.

Additionally, combined use of trails by public visitors and educational groups in high-use areas would lead to congestion and seriously diminish the experience for both groups of visitors.

Noise levels from development near the Piedras Marcadas Pueblo ruin would increase and adversely affect the site and visitors.

Conclusion

Implementing this alternative would provide visitors with a less-than-adequate experience and result in an adverse affect. There would be an increase in vandalism throughout the monument because of the limited visitor and heritage education facilities. This would result in an adverse impact and make it more difficult for visitors to understand the significance of the monument.

Cumulative Impacts

The construction of Unser Boulevard and the recreational trail by the city would benefit national visitors by facilitating access to the mesa top by vehicles, bicycles, horseback, and foot. There would also be a beneficial impact by eliminating vehicular traffic from Boca Negra Canyon. There would be adverse impacts on national visitors by the visual intrusion, increased noise levels, and the barrier of the four-lane highway. Creative design and material use would minimize these impacts.

IMPACTS ON LOCAL VISITORS AND ADJACENT LANDOWNERS

Impact Analysis

There would be no impacts from increased visitor traffic.

Neighborhood access trails and multiuse trails in the monument would accommodate Albuquerque citizens who have traditionally used this landscape to hike, ride

bicycles, and ride horses, thus providing an expanded trail system for city residents. Increased local visitation would continue.

Combined use of trails by visitors and educational groups in high-use areas would lead to congestion and seriously diminish the experience for both groups of visitors.

Noise levels from development near the Piedras Marcadas Pueblo ruin would increase and adversely affect visitors on occasional tours.

Continuation of the existing education program would provide limited opportunities for heritage education.

Conclusion

This alternative would create a monument area primarily for local users and thus would have a beneficial impact on those users. Heritage education would continue to be a small component of the entire education program for the monument.

Cumulative Impacts

The construction of Unser Boulevard, the recreational trail, and the utility corridor would benefit adjacent landowners and local visitors by facilitating access and providing recreation opportunities. Adjacent landowners west of the escarpment would also benefit from the utility access. There would be adverse impacts from visual and noise intrusions from traffic on Unser Boulevard. Creative design and material use would minimize these impacts.

IMPACTS ON ENERGY CONSUMPTION

Impact Analysis

All monument and visitor facilities would use existing structures. Reusing the buildings at Lava Shadows for administrative offices and visitor orientation would eliminate adverse energy consumption impacts by saving the energy required for building the buildings, producing new building materials, and transporting those materials. However, new buildings would be designed and constructed to be more energy efficient.

Conclusion

No adverse energy consumption impacts would result from implementing this alternative.

IMPACTS OF MONUMENT USE AND ACTIVITIES ON EXISTING NOISE LEVELS

Impact Analysis

Constructing parking areas in Rinconada and Piedras Marcadas Canyons would cause temporary increases in noise levels but would not be significant. Operation of these areas would not create a significant increase in noise levels in the monument. Any increase in noise would not be noticeable compared with noise levels adjacent to the monument.

Conclusion

Noise from monument development and operations would not have a significant impact.

Cumulative Impacts

It is expected that noise from proposed adjacent development near Mesa Prieta, Boca Negra and Piedras Marcadas Canyons, the Piedras Marcadas Pueblo ruin, and the volcanoes would adversely affect the monument. Combined noise levels from Unser Boulevard, the expansion of the Double Eagle II Airport, proposed Paseo del Volcan, and proposed adjacent development could cumulatively and significantly increase noise levels in the monument. Mitigation measures regarding Unser Boulevard, the airport, and Paseo del Volcan would be developed with the Federal Aviation Administration, the state, and the city.

IMPACTS ON AIR QUALITY

Impact Analysis

Implementation of the no-action alternative would include some development of parking areas at trailheads. Because the level of development would be much less than under any of the other alternatives, visitors to the monument would primarily be from the local area. Air quality emissions would stay below the de minimus levels as set by the Environmental Protection Agency and would be well below the levels of emissions in the other alternatives.

Due to the lack of information available to determine emission levels generated by constructing the two trailhead parking areas, conformity would be determined during the design phase. If required, construction would be designed to ensure conformity. Limitations on the number of trips, traveling during nonpeak hours only, dust suppression, and other methods would be employed if necessary to ensure that conformity is met. Other emissions, such as ozone, particulates, and lead, would be under de minimus levels as set in the regulations pertaining to nonattainment areas.

Conclusion

No adverse impact on air quality would occur as a result of implementing the no-action alternative. The emissions generated by visitors and staff would not exceed de minimus levels. Temporary adverse impacts might occur during construction activity from dust.

Cumulative Impacts

Particulate matter (dust) from proposed adjacent construction including Unser Boulevard, Double Eagle II airport, and Paseo del Volcan would have temporary adverse impacts on air quality. The use of the adjacent roads, airport, and development would increase emissions.

COMPLIANCE /CONSULTATION AND COORDINATION



Piedras Marcadas Canyon

COMPLIANCE WITH CULTURAL AND NATURAL RESOURCES REQUIREMENTS

In implementing the Petroglyph National Monument general management plan, the Park Service, the state, and the city would comply with all applicable laws and executive orders, including the following.

Architectural Barriers Act of 1968 (42 USC 4151 et seq.) and Rehabilitation Act of 1973 (29 USC 701 et seq.) — All facilities and programs developed would be accessible to visitors with disabilities.

Clean Air Act, as amended (42 USC 7401 et seq.) — Petroglyph National Monument is designated as a class II clean air area. Maximum allowable increases (increments) of sulfur dioxide (SO₂), particulate matter (TSP), and nitrogen oxides (NO_x) beyond baseline concentrations established for class II areas cannot be exceeded. These class II increments would allow modest industrial activities in the vicinity of the monument. Section 118 of the Clean Air Act requires all federal facilities to comply with existing federal, state, and local air pollution control laws and regulations. Petroglyph National Monument would work with the Albuquerque Air Pollution Control Division and the state to ensure that all monument activities meet all requirements. During the design phase for development proposed in the monument, an analysis of anticipated emissions from construction activities would be conducted to ensure conformity with federal and state air quality regulations as part of the Clean Air Act.

Endangered Species Act of 1973, as amended (16 USC 1531 et seq.) — Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service to ensure that any action authorized,

funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitat. The National Park Service is conducting a section 7 consultation with the U.S. Fish and Wildlife Service. Before construction and during the design phase, further surveys and consultation would occur to protect these species.

NPS policy provides protection for species proposed for listing as well as any state-listed species. It is the conclusion of the National Park Service that the proposed action may adversely impact habitat for *Pediocactus papyracanthus* (the grama grass cactus, category 2) and *Mammillaria wrightii* (a state-listed rare species) and might adversely affect the ferruginous hawk (category 2). Consultation would occur with the Natural Heritage Program and the U.S. Fish and Wildlife Service to make further determinations on this and provide for adequate mitigation. The Mesa Prieta area and the site for the heritage education center were the only sites not surveyed for threatened and endangered plant species. Site surveys would be completed during the design phase.

Executive Order 11988, "Floodplain Management" — This order requires all federal agencies to avoid construction within the 100-year floodplain unless no other practical alternative exists. No known floodplains would be affected by the proposed action. Trails are exempt from compliance under NPS guidelines to implement this executive order. During the design stage of any development, the most recent floodplain maps shall be consulted and siting of any

structures would be accomplished while avoiding the 100-year floodplain, unless the activity is exempted.

Executive Order 11990, "Protection of Wetlands" — This order requires federal agencies to avoid, where possible, impacts on wetlands. No known wetlands would be affected by the proposed action. Trails are exempted from compliance under NPS guidelines for implementing this executive order. During the design phase of any development, the most recent wetland maps shall be consulted to ensure that facilities are sited outside of any wetlands.

"Analysis of Impacts on Prime and Unique Agricultural Lands in Implementing the National Environmental Policy Act" (45 CFR 59189) — Federal agencies are required to analyze the impacts of federal actions on agricultural lands, in accordance with the National Environmental Policy Act. This policy was developed to minimize the effect of federal programs in converting prime, unique, or locally important farmland to nonagricultural uses. According to the Soil Conservation Service there are no prime and unique farmlands within the national monument.

During the design phase for all development proposed in the monument, NEPA compliance would be conducted as determined necessary by the National Park Service.

The following additional actions would be taken to ensure compliance with federal, state, and city laws and regulations.

Consultation with the U.S. Fish and Wildlife Service and the New Mexico Natural Heritage Program would be carried out before construction to ensure that no new listed species have been found on site.

During design, the most recent wetland and floodplain maps would be consulted to ensure that development is not located in either one of these resources. In the event that new data shows floodplain or wetlands in areas previously not identified, development would be sited to avoid these areas or if not possible, a statement of findings would be prepared in accordance with NPS guidelines for implementing Executive Orders 11990 and 11988.

During design, consultation with the New Mexico Environmental Improvement Division shall be accomplished to ensure compliance with the state's 401 water quality certification program, the National Pollution Discharge Elimination System (NPDES) for stormwater discharge, and the state's groundwater protection program.

If any unknown hazardous waste is found in areas proposed for development or visitor use, the National Park Service would comply with the Comprehensive Environmental Response Compensation and Liability Act (42 USC 9601 et seq.) to determine if resources are being polluted by the substance or if it presents a health and safety issue. If any excavated material is determined to be hazardous, the National Park Service would comply with the Resource Conservation and Recovery Act (42 USC 6901 et seq.)

The National Park Service would work with the city and Bernalillo County, to the extent possible, to comply with the intent of all applicable regulations and policies including the Storm Drainage, Flood, and Erosion Control Ordinance of 1986, and the city's 1983 *Development Process Manual*. Those regulations and policies that protect monument resources to a greater extent than that provided for under federal law would be enforced and adhered to. Consultation would continue with the city of Albuquerque during the design and

construction phase for development of the monument.

The National Park Service is mandated to preserve and protect its cultural resources — through the organic act of August 25, 1916, and through specific legislation such as the Antiquities Act of 1906, the National Environmental Policy Act of 1969 (as amended), and the National Historic Preservation Act of 1966, which is described below. Cultural resources in Petroglyph National Monument would be managed in accord with these acts and in accord with chapter V of the *NPS Management Policies*, the *Cultural Resources Management Guideline* (NPS 28), the Advisory Council on Historic Preservation's implementing regulations regarding "Protection of Historic Properties" (36 CFR 800), and the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* (FR 48:44716-40). Other relevant policy directives and legislation are detailed in NPS 28.

As part of its cultural resource management responsibilities, as directed by section 110 of the National Historic Preservation Act, the National Park Service surveys and evaluates all cultural resources on lands under its jurisdiction. Cultural resources are evaluated by applying the eligibility criteria for the National Register of Historic Places. All cultural resources in the monument eligible for the national register would be recorded according to the highest professional standards. Consultation with traditionally associated American Indian and Atrisco groups would occur before nomination of ethnographic resources.

Before preliminary design, a professional archeologist would determine the need for further archeological inventory or testing evaluation. Any such studies would be carried out in consultation with the state historic preservation officer and concerned

Pueblo Indians before construction. Any large-scale archeological investigations would be undertaken in consultation with the state historic preservation office and the Pueblo Indians.

Responsibility for protecting archeological resources is included under several laws mentioned earlier as well as the Archeological Resources Protection Act of 1979.

Section 106 of the National Historic Preservation Act of 1966 requires that federal agencies having direct or indirect jurisdiction over undertakings consider the effect of those undertakings on properties on or eligible for listing on the national register and afford the Advisory Council on Historic Preservation and the state historic preservation office an opportunity to comment. Toward that end, the National Park Service would work with these entities to meet the requirements of 36 CFR 800 and the August 1990 programmatic agreement among the National Conference of State Historic Preservation Officers, the Advisory Council on Historic Preservation, and the Park Service. The agreement requires the Park Service to work closely with the state historic preservation office and the advisory council in planning and design for new and existing NPS areas, and provides for their review of monument development projects at four stages — task directive, policy review draft, and draft and final documents. The state historic preservation office and the Advisory Council on Historic Preservation would be invited to participate in the scoping process for design of the proposed facilities.

Comments on the *Draft General Management Plan / Development Concept Plan / Environmental Impact Statement* received from the Advisory Council on Historic Preservation and the state historic preservation office would be included in the *Final General Management Plan /*

Development Concept Plan / Environmental Impact Statement.

Also this agreement provides for a number of "programmatic exclusions" for specified actions that are not likely to have an adverse effect on cultural resources. These actions may be implemented without further review by the state historic preservation office or the advisory council provided that NPS internal review finds the actions meet certain conditions and this review is documented with an assessment of effect. Undertakings, as defined in 36 CFR 800, not specifically excluded in the programmatic agreement must be reviewed by the state historic preservation office and the advisory council during the planning and design stages and before implementation.

Internally, the National Park Service will complete an "Assessment of Effect on Cultural Resources" form (XXX form) before implementing any proposed actions. This is necessary to document any project effects, outline actions proposed to mitigate any effects, and document that the proposed action flows from the general management plan. All implementing actions for cultural resources would be reviewed, using the XXX form, and certified by regional office cultural resource specialists as specified in NPS 28.

To ensure that general management plan proposals that might affect properties eligible for the national register comply with provisions of section 106, the Advisory Council on Historic Preservation and the New Mexico state historic preservation office were invited to participate in the planning process. Representatives of the state historic preservation office have been regular participants in core team planning and will, along with the advisory council, have an opportunity to review and comment on the draft general management plan.

As elements of the plan are implemented, site-specific information on proposed actions and affected properties would be submitted to the state historic preservation office and the advisory council for their review and comment to ensure adequate mitigation of any adverse effects. These different actions for each alternative are delineated in the text of this management plan and are summarized in tables 12, 16, 18, and 20. Also included in these tables are actions that are either programmatic exclusions under the programmatic agreement among the National Conference of State Historic Preservation Officers, the Advisory Council on Historic Preservation, and the National Park Service or that are subject to further 106 consultation with the state historic preservation office and the advisory council.

In the interim, no potentially eligible property would be inalterably affected without consultation with the state historic preservation office and the Advisory Council on Historic Preservation.

Especially relevant to the management of Petroglyph National Monument are the various laws, rules, regulations, etc. that deal with American Indian relationships and discovery of human remains. Throughout the planning process representatives from the National Park Service, the city, and the state met with concerned Indian and Atrisco land grant groups, and dialogue regarding the project is expected to continue in the future. The principal concerns raised in discussions have been continued access for religious purposes, traditional use of resources, protection of sites, and facility development. In 1992 a *Rapid Ethnographic Assessment* (Evans et al. 1993) was conducted by researchers from the University of Arizona to help define the presence and general location of ethnographically sensitive areas within the monument and to gain an understanding of Indian and land grant heir concerns.

The 1992 amendments to the National Historic Preservation Act and the Archeological Resources Protection Act provide means whereby information about the character, location, or ownership of archeological sites, historic properties, and ethnographic sites including shrines and other religious places might be withheld from public disclosure. This provision is especially important in cases where disclosure could risk harm to the resource or impede the use of a traditional religious site by practitioners. Monument managers would honor Indians' requests for confidentiality of information received as part of ongoing surveys.

The American Indian Religious Freedom Act provides for the preservation of Indian rights to practice their traditional beliefs. The National Park Service will continue to consult with American Indian tribes on a government-to-government basis. This special legal relationship is outlined in the secretary's April 29, 1994, memorandum for the heads of executive departments and agencies. In keeping with this mandate and provisions of the National Environmental Protection Act, the Park Service will consult with Indian groups on planning and management activities that affect them. The Park Service and the city would develop and accomplish their programs in a way that reflects respect for the religious beliefs, traditions, and other cultural values of the Indian tribes who have ancestral ties to the monument. The Park Service and the city would also strive to ensure privacy for American Indians to pursue religious activities without interference or inappropriate observation by those who want to learn of Indians ways.

Training programs would cover the etiquette to be followed when monument staff encounter religious activities or sites and offerings. Consultation with American

Indian groups would continue in the future, helping to improve understanding and achieve common goals. Consultation is especially critical to reach mutually acceptable solutions to questions of archeological excavations, resource preservation, and visitor use. All possible measures would be taken to resolve differences reasonably so monument plans and actions respect the cultural and ethnographic context of sites.

Discovery of significant archeological resources would be followed by protective measures. The Native American Graves Protection and Repatriation Act addresses the rights of tribes and consultation procedures regarding to certain human remains and cultural items with which they are affiliated. Because of the monument's long human history and known association with Pueblo communities, there is potential for discovery of human remains and associated items of cultural patrimony.

To comply with the provisions of this act and its implementing regulations (43 CFR 10), monument managers would establish a prompt and effective notification system as outlined in the law to contact and consult with concerned groups regarding discovery of human remains and associated objects. Managers would deal with burials on a case-by-case basis with informed awareness of tribal concerns. Burials and sacred objects would be afforded the utmost respect, and the National Park Service and the city would consult with tribes regarding remains associated with these groups. A Native American Graves Protection and Repatriation (NAGPRA) implementation plan would be developed, which would include strategies to include discussions with Pueblo Indians regarding archeological investigations and inadvertent discoveries.

CONSULTATION AND COORDINATION

Public involvement and consultation are key components throughout the preparation of the *General Management Plan / Development Concept Plan / Environmental Impact Statement*. The NPS planning staff works very closely with the city and state agencies that have responsibilities for land and program management within and adjacent to the monument. In addition, there have been numerous meetings with city boards and advisory groups, organizations, and neighborhood and business organizations.

STEPS IN THE PLANNING PROCESS

The first step in the planning process was the establishment of an intergovernmental core planning team to coordinate and prepare the *General Management Plan / Development Concept Plan / Environmental Impact Statement*. Because of the partnership nature of Petroglyph National Monument, the general management plan is being prepared by a core team that includes representatives from four city agencies, two state agencies, the American Indian Pueblo community, the Federal Aviation Administration, and the National Park Service. The core team has met throughout the planning process to develop and refine statements of purpose, to identify the significant resources of and the objectives for the monument, to develop alternatives for visitor use and management, and to assess the impacts of implementing each of the alternatives.

To ensure participation from the many governmental agencies that are concerned with the monument, an agency coordinating team was established. The coordinating team includes representatives with expertise in various disciplines from city, county, state, and federal agencies as well

as American Indian governments. The coordinating team advises the core team regarding past, ongoing, and proposed projects and programs that have an effect on the monument and provides input on various aspects of the plan preparation.

Throughout the planning process the team has met with governmental organizations, American Indian groups, Atrisco heirs, neighborhood groups, and other interested people to identify issues and exchange information. Another participant in preparing the general management plan is the Petroglyph National Monument Advisory Commission. As directed by monument legislation, the commission is composed of representatives from various interested entities throughout the region. The National Park Service keeps the advisory commission informed of their planning activities and regularly consults with the advisory commission. The advisory commission has taken a very active interest in planning for the monument and met regularly with the Park Service to review alternatives and make recommendations regarding other alternatives.

In November 1992 the first planning newsletter, including a comment and response form, was distributed. The purpose of this newsletter was to let the local and national community know that a plan and environmental impact statement were being prepared for the monument. The newsletter outlined the steps in the planning process, some of the issues to be addressed by the plan, the overall plan schedule, the purposes and significant resources of the monument, and preliminary goals. Two public open houses were conducted by the planning and monument staffs to enable one-on-one interaction with concerned residents. A series of meetings

were held with community boards, organizations, and groups to discuss the planning process.

To maintain a dialogue with the public, the planning team members and monument staff held a second series of open houses on December 7 and 8, 1992. At these meetings, planning team members presented initial conceptual alternatives that were described in the February 1993 newsletter for managing the monument.

A second newsletter, published in February 1993, presented the refined purpose and significance statements and the planning team's three conceptual alternatives for visitor use and resource management. This newsletter also included a comment and response form, which will be summarized in the next document.

A series of public workshops was held to allow opportunities for the public to discuss the various elements of the alternatives. Planning team members met with city boards and committees, organizations, neighborhood associations, the monument advisory commission, representatives of the American Indian community, and individuals to discuss the issues and alternatives.

The partnership arrangement of this monument with the city, state, the core team, consisting of individuals from state and local offices and an advisory commission that have taken an active interest in the plan, has greatly affected the degree of public participation. Because advisory commission meetings are by law open to the public, the public has seen alternatives in very early forms, before they were complete, before analysis had been completed, and before approval by park service directorate.

Revised alternatives were presented in October 1993 to the commission. Based on

input from a commission subcommittee and others, the National Park Service revised the alternatives in December 1993 and these alternatives were presented to the public. There were extensive comments on the alternatives.

In November 1994 a preliminary draft of this document was reviewed by the Petroglyph National Monument Advisory Commission and the intergovernmental core planning team. Revisions have been made based on comments received. Verbal comments were received from the city of Albuquerque staff, but official comments have not been provided. The National Park Service has attempted to work with the city to resolve issues that were unclear or contrary to NPS policies. The mayor of Albuquerque was not interested in discussing comments on the preliminary draft and indicated that the city would prepare its own plan. The Mayor has invited the National Park Service to cooperate in the preparation of a city plan. The National Park Service will attempt to work with the city in the preparation of all monument-related plans.

The Draft General Management Plan / Development Concept Plan / Environmental Impact Statement will be reviewed by the public during a 90-day public comment period that will include public meetings. Comments on the Draft General Management Plan / Development Concept Plan / Environmental Impact Statement will be summarized, and appropriate revisions will be made in the Final General Management Plan / Development Concept Plan / Environmental Impact Statement. The final document will include responses to substantive comments.

AMERICAN INDIAN CONSULTATION

To facilitate consultation with American Indian and Hispanic groups, the National

Park Service conducted a rapid ethnographic assessment. This study identified the principle concerns of American Indian groups and how the National Park Service should focus its consultation efforts. The monument staff is continuing its efforts to enhance communication and consultation with both American Indian and Hispanic groups as the planning process proceeds regarding continuing and long-term planning and management issues.

Based on the results of the ethnographic assessment, monument and planning team members met with American Indian and Hispanic representatives and invited representatives to participate in core team meetings. Park and planning team members have had both short and long term interests in meeting with American and Hispanic representatives. The Park Service has had the desire to initiate communication and understanding of monument and planning issues as well as an understanding of American Indian and Hispanic interests.

Formally, this consultation has been and will continue to be through the American Indian Consultation Committee, who conducted their first meeting on July 7, 1993. This consultation committee is comprised of representatives from the All

Indian Pueblo Council Inc., Five Sandoval County Pueblos Inc., Sandia Pueblo, Santa Anna Pueblo, and Zia Pueblo.

Throughout the preparation of this management plan, the planning team has involved and informed the American Indian Pueblo community of the planning process and issues that could affect lands that are significant to the American Indians.

The monument staff recognizes that the lands within the monument may have significance to several Pueblos and nearby groups and that most religious practices are very private. Opportunities will be provided for American Indian groups to comment on development and visitor use plans in a manner that enables adequate time for the Pueblos and Tribes to consider the proposals.

American Indians will be provided reasonable access to all portions of the monument consistent with 36 CFR 2.51. The superintendent may adopt temporary closures of specific portions of the monument so that American Indians may practice ceremonies or rituals without interference from non Indians. Monument staff will be trained in identifying ritual and religious practices to ensure privacy for these practices.

LIST OF PREPARERS

PLANNING TEAM

Denver Service Center
Lawrence Beal, Chief of Planning,
Community Planner
Mary Riddle, Natural Resources
Specialist
Helen Starr, Landscape Architect (project
completion)
Holly Kirchner, Natural Resource
Specialist (project completion)
Diane Rhodes, Archeologist and Cultural
Resources Specialist
Marilyn Hof, Planner/Interpretation
Specialist
Richard Lichtkoppler, Resource
Economist
David Hesker, Visual Information
Specialist
Christy Fischer, Writer/Editor
Paula Machlin, Landscape Architect
(project initiation)
Michael Rees, Natural Resources
Specialist (project initiation)
Petroglyph National Monument
Stephen Whitesell, Superintendent
Diane Souder, Chief of External Affairs
Reed McCluskey, Chief of Natural
Resources and Protection
Paul Henderson, Former Chief of
Interpretation and Cultural Resources
Greg Gnesios, Chief of Interpretation and
Cultural Resources
Southwest Regional Office
Joan Mitchell, Branch Chief of Planning
George Esber, formerly Office of
American Indian Programs (project
initiation)
Janet Schmitt, Division of Environmental
Compliance
Ron Short, Director, Planning
Department
Sandy Fish, Planning Department
Harpers Ferry Center
Sam Vaughn, Interpretive Planner

City of Albuquerque,
Jay Hart, Open Space Superintendent,
Open Space Division
Matthew Schmader, Archeologist, Open
Space Division
Randy Reed, formerly with Advance
Planning Division
DuWayne Ordonez, Parks and General
Services Department
John Hartmann, Public Works
Department
Rex Funk, former Open Space
Superintendent, Open Space Division
State of New Mexico
Robert Findling, Chief of Project
Management and Design, State Park
and Recreation Division
Michael Romero Taylor, State Historic
Preservation Officer
Thomas Merlan, former State Historic
Preservation Officer
Jim O'Hara, formerly with New Mexico
Historic Preservation Division
Pueblo Representative
Earl Gachupin, Zia Pueblo
Federal Aviation Administration
Joy Porter, Environmental Specialist

CONSULTANTS

Denver Service Center
Joel Kussman, Planning Branch Chief
Allen Hagood, Geologist
Elmer Hernandez, Transportation
Engineer
Ron Johnson, Planning Section Chief
Judy Shafer, Senior Section 106
Compliance Specialist
Kit Mullen, Senior NEPA Compliance
Specialist
Jim Straughan, Supervisory Highway
Engineer
Howard Wagner, Branch of Roads and
Trails
Jim Ellis, Geotechnical Engineer

Jan Harris, Outdoor Recreation Planner
Ron Treants, Architect
Mark Kalvels, Civil Engineer
Southwest Regional Office
Doug Faris, Former Associate Regional
Director for Planning
Mary Gibson, Former, Deputy Assistant
Regional Director for Planning
Kevin Brandt, Acting Associate Regional
Director for Planning
Ed Natay, Office of American Indian
Programs
Harlan Hobbs, Chief, Division of Lands
Bob Muller, Division of Lands
Peggy Froeschauer, Cultural Landscape
Program Manager
Ron Ice, former Regional Archeologist
Arthur Ireland, Archeologist
Joe Sovick, Chief, Office of
Environmental Coordination

Petroglyph National Monument Advisory
Commission
Bob Grant, Chairman
Jaime Chavez
Joe S. Chavez
Gerry Falls
Rosemary Harris
Ambrosio Ortega
Ray B. Powell, Jr.
Coda Roberson
William F. Weahkee
NPS Southwest Regional Office,
Regional Director
Balloffett & Associates, Inc., Denver,
Colorado
U.S. Geological Survey, Albuquerque
Bureau of Applied Research in
Anthropology, University of Arizona,
Tucson, Arizona

APPENDIXES, BIBLIOGRAPHY, AND INDEX



Vulcan Volcano



Mesa top and volcanoes, looking northwest



Visitors on developed trails in Boca Negra Canyon



Piedras Marcadas Canyon, looking north

APPENDIX A: LEGISLATION

104 STAT. 272

PUBLIC LAW 101-313—JUNE 27, 1990

Public Law 101-313
101st Congress

An Act

June 27, 1990
[S. 286]

To establish Petroglyph National Monument and Pecos National Historical Park in the State of New Mexico, and for other purposes.

Public lands.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Petroglyph
National
Monument
Establishment
Act of 1990.
16 USC 431 note.

TITLE I—PETROGLYPH NATIONAL MONUMENT

SECTION 101. SHORT TITLE AND CONGRESSIONAL FINDINGS.

(a) This title may be cited as the "Petroglyph National Monument Establishment Act of 1990".

(b) The Congress finds that—

(1) the nationally significant Las Imagines National Archeological District on Albuquerque's West Mesa Escarpment contains more than 15,000 documented and prehistoric and historic petroglyphs;

(2) the district also contains approximately sixty-five other archeological sites;

(3) the West Mesa Escarpment and the petroglyphs are threatened by urbanization and vandalism, and hundreds of petroglyphs have already been destroyed;

(4) the State of New Mexico has shown great leadership by recognizing the importance of the archeological resources of the West Mesa Escarpment through the establishment of the Las Imagines National Archeological District;

(5) the city of Albuquerque has played a significant role in the preservation of the natural, cultural, and recreational resources of the West Mesa Escarpment;

(6) the Middle Rio Grande Pueblo Tribes have shown a strong and sincere interest in the preservation of their heritage through protection of the West Mesa Escarpment;

(7) the Atrisco Land Grant, now held by Westland Development Company, Incorporated, a corporation whose stock is owned primarily by heirs of the Atrisco Land Grant, has played a significant role in the settlement of the West Mesa area since 1692, and the corporation's shareholders have shown a strong interest in the preservation of their traditional lands;

(8) the National Park System has no unit established for the specific purpose of protecting, preserving, and interpreting prehistoric and historic rock art; and

(9) in light of the national significance of the West Mesa Escarpment and the petroglyphs and the urgent need to protect the cultural and natural resources of the area from urbanization and vandalism, it is appropriate that a national monument be established in the West Mesa Escarpment area, near Albuquerque, New Mexico.

SEC. 102. ESTABLISHMENT OF PETROGLYPH NATIONAL MONUMENT.

(a) In order to preserve, for the benefit and enjoyment of present and future generations, that area in New Mexico containing the nationally significant West Mesa Escarpment, the Las Imagines National Archeological District, a portion of the Atrisco Land Grant, and other significant natural and cultural resources, and to facilitate research activities associated with the resources, there is hereby established the Petroglyph National Monument (hereinafter in this title referred to as the "monument") as a unit of the National Park System. The monument shall consist of approximately 5,280 acres generally known as the Atrisco Unit, as depicted on the map entitled "Boundary Map, Petroglyph National Monument", numbered NM-PETR-80,010C and dated June 1990, which shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior, in the offices of the Department of Energy, Minerals, and Natural Resources of the State of New Mexico, and in the office of the mayor of the city of Albuquerque, New Mexico.

(b) The monument shall be administered by the Secretary of the Interior (hereinafter in this title referred to as the "Secretary") or, if the monument is expanded pursuant to section 104(a), by the Secretary in cooperation with the State of New Mexico (hereinafter in this title referred to as the "State") or the city of Albuquerque, New Mexico (hereinafter in this title referred to as the "city"), in accordance with section 105.

(c) Within 6 months after the date of enactment of this title, the Secretary shall file a legal description of the monument with the Committee on Energy and Natural Resources of the United States Senate and the Committee on Interior and Insular Affairs of the United States House of Representatives. Such legal description shall have the same force and legal description as if included in this title, except that the Secretary may correct clerical and typographical errors in such legal description. The legal description shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior, in the offices of the Department of Energy, Minerals, and Natural Resources of the State of New Mexico, and in the office of the mayor of the city of Albuquerque, New Mexico: *Provided*, That the Secretary may from time to time, after completion of the general management plan referred to in section 108(a), may make minor adjustments to the monument boundary by publication of a revised map or other boundary description in the Federal Register.

SEC. 103. LAND ACQUISITION AUTHORITY.

(a) The Secretary is authorized to acquire lands and interests therein within the monument boundary by donation, purchase with donated or appropriated funds, exchange, or transfer from any other Federal agency, except that lands or interests therein owned by the State or a political subdivision thereof may be acquired only by donation or exchange.

Gifts and
property.

(b) Where the surface and subsurface estates of private land to be acquired are separately owned, the Secretary shall acquire the subsurface estate to such land prior to or at the same time the surface estate is acquired: *Provided*, That this subsection shall not be applicable if the Secretary determines that the prior acquisition of the surface estate is necessary—

(1) to prevent damage to the resources of the monument; or

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(2) to properly manage and interpret the monument in accordance with sections 102 and 105.

(c)(1) The Secretary is authorized to exchange Federal lands within the area described on the map referred to in section 102(a) as the Piedras Marcadas Unit for lands owned by the city within the area described as the Atrisco Unit on such map.

(2) The Secretary is authorized to exchange Federal lands within the area described on the map referred to in section 102(a) as the Boca Negra Unit for lands owned by the State within the area described as the Atrisco Unit on such map.

(3) Exchanges shall be on the basis of equal value, and either party to the exchange may pay or accept cash in order to equalize the value of the properties exchanged.

Gifts and
property.

(d) Prior to acquiring fee simple ownership of private lands or interests therein within the monument boundary, the Secretary is authorized to acquire an appropriate interest in such land by donation or for a nominal fee from the owner or owners of such lands for the purpose of providing immediate protection against trespass or vandalism or initiating any resource inventories necessary to carry out the purposes of this title.

SEC. 104. EXPANSION OF THE MONUMENT.

(a) Upon the execution of a binding agreement between the Secretary, the State, and the city that the lands identified in this subsection shall be perpetually managed in accordance with section 105, the Secretary shall include such lands, totaling approximately 1,994 acres, within the monument boundary. The lands referred to in this subsection are:

(1) the approximately 1,779 acres generally known as the Piedras Marcadas Unit, as depicted on the map referred to in section 102(a); and

(2) the approximately 215 acres generally known as the Boca Negra Unit, as depicted on the map referred to in section 102(a).

(b)(1) The Secretary is authorized to acquire, as provided in section 103(a), some or all of the approximately 95 acres of land, or interests therein, within the area identified as "Potential Addition" on the map referred to in section 102(a), if, after consultation with the Petroglyph National Monument Advisory Commission established under section 110, the Secretary determines that such acquisition would further the purposes of this title.

(2) The authority of the Secretary to make acquisitions pursuant to paragraph (1) shall expire on the date three years after the date of enactment of this Act.

(3) Any lands acquired pursuant to paragraph (1) shall be incorporated into the monument and managed accordingly.

SEC. 105. ADMINISTRATION AND MANAGEMENT OF THE MONUMENT.

(a) The Secretary shall administer, manage, and protect the monument in accordance with the Act of August 25, 1916 (39 Stat. 535; 16 U.S.C. 1 et seq.), the Act of August 21, 1935 (49 Stat. 666; 16 U.S.C. 461 et seq.), and this title, and in such a manner as to preserve, for the benefit and enjoyment of present and future generations, its cultural and natural resources, and to provide for the interpretation of and research on such resources.

(b) Units of the monument which may be added pursuant to section 104(a) shall be managed and developed in accordance with management and operational plans prepared concurrently with the

National Park Service, consistent with section 108. Visitor use and interpretive programs within such units shall be undertaken consistent with plans developed with the assistance of the National Park Service.

(c) The Secretary is authorized to enter into cooperative agreements with either the State or the city under which the Secretary may manage and interpret any lands owned by the State or the city, respectively, within the boundaries of the monument.

Contracts.

(d) In order to encourage a unified and cost effective interpretive program of the natural and cultural resources of the West Mesa Escarpment and its environs, the Secretary is authorized to enter into cooperative agreements with other Federal, State, and local public departments and agencies, Indian tribes, and nonprofit entities providing for the interpretation of these resources. Such agreements shall include, but need not be limited to, a provision for the Secretary to develop and operate interpretive facilities and programs on lands and interests in lands outside the monument boundary, with the agreement of the owner or the administrator thereof. Such cooperative agreements may also provide for financial and technical assistance for the planning and implementation of interpretive programs and minimal development related to these programs.

Contracts.
Conservation.

(e) Federal laws generally applicable to units of the National Park System, including but not limited to, the National Environmental Policy Act of 1969 and the Archeological Resources Protection Act of 1979, shall apply to the monument. The Secretary is authorized to pursue concurrent jurisdiction of the monument for the purposes of law enforcement and implementation of Federal regulations.

SEC. 106. LAND USE AND TRANSPORTATION PLANNING.

The Secretary may participate in land use and transportation management planning conducted by appropriate local authorities for lands adjacent to the monument and may provide technical assistance to such authorities and affected landowners for such planning.

SEC. 107. EXISTING TRANSMISSION OR DISTRIBUTION FACILITIES.

Nothing in this title shall be construed as authorizing or requiring revocation of any interest or easement for existing transmission or distribution facilities or prohibiting the operation and maintenance of such facilities within or adjacent to the monument boundary.

SEC. 108. GENERAL MANAGEMENT PLAN.

(a) Within 3 years from the date funding is made available for the purposes of this section, the Secretary, in cooperation with the city and the State, shall develop and transmit to the Committee on Energy and Natural Resources of the United States Senate and the Committee on Interior and Insular Affairs of the United States House of Representatives, a general management plan for the monument consistent with the purposes of this title, including, but not limited to—

- (1) a statement of the number of visitors and types of public use within the monument which can be accommodated in accordance with the protection of its resources;
- (2) a resource protection program;
- (3) a general interpretive program;

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(4) a plan to implement the joint resolution entitled "American Indian Religious Freedom", approved August 11, 1978 (42 U.S.C. 1996);

(5) a general development plan for the monument, including proposals for a visitors' center, and the estimated cost thereof; and

(6) a plan for the Rock Art Research Center established in section 109.

(b) The general management plan shall be prepared in consultation with the Petroglyph National Monument Advisory Commission established pursuant to section 110, appropriate Indian tribes and their civil officials, the heirs of the Atrisco Land Grant, the New Mexico State Historical Preservation Office, and other interested parties.

Contracts.

(c) The Secretary shall undertake, in consultation and cooperation with appropriate New Mexico Indian tribes and their civil officials, research on other Rio Grande style rock art sites on Federal lands in New Mexico, and through cooperative agreements with State and willing private landowners, on non-Federal lands. The Secretary shall provide the Committee on Energy and Natural Resources of the United States Senate and the Committee on Interior and Insular Affairs of the United States House of Representatives within 3 years of the date funding is made available for the purposes of this section, a report that—

Reports.

(1) lists various locations of Rio Grande style rock art;

(2) identifies the ownership of the rock art;

(3) identifies the condition of the resources; and

(4) identifies the appropriate type of technical assistance needed for the protection and care of these resources.

The report shall be updated and transmitted to such committees every 2 years thereafter.

Cultural
programs.
Indians.
Minorities.
Public buildings
and grounds.

SEC. 109. ROCK ART RESEARCH CENTER.

(a) In order to provide for research relating to Rio Grande style rock art, undertake comprehensive evaluations of petroglyphs within the monument, prepare interpretive programs that are sensitive to the concerns of the Indian and Hispanic peoples, and relate monument resources to other styles and forms of rock art, the Secretary, acting through the National Park Service and in cooperation with the University of New Mexico, other educational institutions, foundations, Indian tribes, and private entities, shall establish a Rock Art Research Center (hereinafter in this title referred to as the "Center").

(b) The Center shall function as a focal point for the systematic and scholarly collection, analysis, and dissemination of information relating to Rio Grande style rock art, and other forms of rock art within the region.

Education.

(c) The Center shall produce research data and educational materials that will enhance public understanding of prehistoric and historic rock art.

(d) The Center shall provide for a broad program of research including ethnographic studies, resource management techniques, and comparative studies of rock art forms and styles.

(e) Research shall be primarily directed toward rock art managed by the National Park Service. The Secretary may enter into cooperative agreements with other agencies and entities as may be appropriate to carry out the requirements of the Center.

(f) The Secretary, acting through the National Park Service, is authorized to undertake research and assist in the management and protection of Rio Grande style rock art sites on public and, with the agreement of the landowner, private lands within the Galisteo Basin. The Secretary is authorized to enter into cooperative agreements with landowners of such rock art sites and expend appropriated funds for research, site protection, and interpretive programs. Research shall include the identification and mapping of rock art sites and the development of protection options.

Contracts.

SEC. 110. PETROGLYPH NATIONAL MONUMENT ADVISORY COMMISSION.

Establishment.

(a) There is hereby established the Petroglyph National Monument Advisory Commission (hereinafter in this title referred to as the "Commission"). The Commission shall be composed of eleven members appointed by the Secretary for terms of 5 years as follows:

(1) one member, who shall have professional expertise in history or archeology, appointed from recommendations submitted by the Governor of the State of New Mexico;

(2) one member, who shall have professional expertise in history or archeology, appointed from recommendations submitted by the mayor of the city of Albuquerque, New Mexico;

(3) one member, who shall have professional expertise in Indian history or ceremonial activities, appointed from recommendations submitted by the All Indian Pueblo Council;

(4) one member, who shall be a shareholder of the Westland Development Company, Incorporated;

(5) one member, who shall be an heir of the Atrisco Land Grant;

(6) one member, who shall be an affected landowner;

(7) one member, who shall have professional expertise in Indian rock art;

(8) one member, who shall have professional expertise in cultural anthropology;

(9) one member, who shall have professional expertise in geology;

(10) one member from the general public; and

(11) the Director of the National Park Service, or his or her designee, *ex officio*.

(b) Any member of the Commission may serve after the expiration of his or her term until a successor is appointed. A vacancy in the Commission shall be filled in the same manner in which the original appointment was made.

(c) Members of the Commission shall serve without pay. While away from their homes or regular places of business in the performance of services for the Commission, members of the Commission shall be allowed travel expenses, including per diem in lieu of subsistence, in the same manner as persons employed intermittently in Government service are allowed expenses under section 5703 of title 5, United States Code.

(d) The Chair and other officers of the Commission shall be elected by a majority of the members of the Commission to serve for terms established by the Commission.

(e) The Commission shall meet at the call of the Chair or a majority of its members, but not less than twice annually. Six members of the Commission shall constitute a quorum. Consistent with the public meeting requirements of section 10 of the Federal Advisory Committee Act (5 U.S.C. App.), the Commission shall, from

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time to time, meet with persons concerned with Indian history and historic preservation, and with other interested persons.

(f) The Commission may make such bylaws, rules, and regulations as it considers necessary to carry out its functions under this title. Section 14(b) of the Federal Advisory Committee Act (5 U.S.C. App.) shall not apply to the Commission.

(g) The Commission shall advise the Secretary on the management and development of the monument, and on the preparation of the general management plan referred to in section 108(a). The Secretary, or his or her designee, shall from time to time, but at least semiannually, meet and consult with the Commission on matters relating to the management and development of the monument.

Termination
date.

(h) The Commission shall cease to exist 10 years after the date of its first meeting.

SEC. 111. AUTHORIZATION OF APPROPRIATIONS.

Reports.

There are authorized to be appropriated such sums as may be necessary for the purposes of this title. The Secretary shall prepare and submit to the Committee on Energy and Natural Resources of the United States Senate and the Committee on Interior and Insular Affairs of the United States House of Representatives, concurrently with the submission to Congress of the President's proposed budget for the second fiscal year beginning after the date of enactment of this title, and every 5 years thereafter, a report on the status of the agreement referred to in section 104(a), its associated costs, and any proposed alterations to the agreement.

APPENDIX B: PLANNING / MANAGEMENT OBJECTIVES

The Petroglyph National Monument authorizing legislation (PL 101-313) and the NPS *Management Policies* (NPS 1988) provided primary direction for monument planning. In addition, the following planning objectives were established.

Management objectives, done for each NPS unit, provide a framework for conserving monument resources, integrating the monument into its surrounding environment, and accommodating public use in accordance with NPS *Management Policies*. Based on NPS policies and direction provided in the enabling legislation, the following are the management objectives for Petroglyph National Monument. These were developed by the core team and refined through later reviews.

Overall Objectives

- To preserve monument resources, including the petroglyphs and their context, the other archeological sites, the volcanoes and geologic windows, the cultural landscape, and the views from and of the monument, and ensure that all public use of the monument is compatible with this objective.
- To provide opportunities for visitors to see and learn about monument resources, including the petroglyphs and their context, the other archeological sites, the volcanoes and geologic windows, the cultural landscape, and the views from and of the monument, in ways that show respect for the area's cultural and spiritual significance and value.
- To design and locate monument facilities, roads, and trails and to limit that development to those facilities needed for management and visitor services in order to minimize impacts on monument resources and meet sustainable design goals.
- To ensure, consistent with the American Indian Religious Freedom Act, access for the spiritual activities of American Indians.
- To manage the natural and cultural resources in ways that allow for the traditional use by Pueblo communities and land grant heirs to continue.
- To work cooperatively with the city and state to ensure that the monument's natural and cultural resources are managed consistently in accordance with federal law and this plan.
- To work with developers of adjacent lands so that these lands may be developed in a manner that is compatible with monument resource values.
- To protect the natural and cultural resources for research and public enjoyment.
- To encourage the participation of adjacent neighborhoods, developments, and community business leaders in the protection of monument resources.

Specific Resource Objectives

- To maintain and restore the natural conditions and ecological processes to the degree practicable given the urban landscape and resource preservation and protection objectives.
- To establish a comprehensive resource information base to monitor change and support scientific and educational objectives.
- To develop and maintain an open, consultative relationship with the Pueblo communities and Atrisco land grant heirs regarding uses of monument resources.
- To maintain the natural biodiversity of the monument resources and, where practicable and necessary, restore this biodiversity. To make vegetated areas within developed areas of the monument be as compatible as possible with native plant communities.

- To maintain the scenic vistas to and from the monument.
- To maintain minimal noise intrusion.

Visitor Experience/Interpretation Objectives

The following visitor experience objectives define those experiences that are so central to the monument's purpose and significance that all visitors should have access to them.

- To provide the opportunity for visitors to understand, learn about, see, respect, and appreciate (1) the value and importance of the petroglyphs and their context as a cultural expression and as spiritually significant to the Pueblo culture, (2) the importance of the escarpment, volcanoes, and other archeological resources by themselves and in the continuum of American Indian and Hispanic cultures, (3) the spiritual and inspirational qualities of the monument, (4) the different cultures associated with the monument.
- To have the monument story unfold naturally as visitors encounter well-integrated facilities, interpretive media, informed staff, and monument resources.
- Because of this greater understanding and appreciation, to show respect for and want to help preserve and protect monument resources.
- To understand the reasons why the monument was set aside by Congress, which are identified in the primary interpretive themes (see the "Interpretation and the Visitor Experience" section).
- To be aware of options available to them, know where to go for assistance, and know how to visit the monument safely (orientation).
- To provide visitors with information about the petroglyphs before they actually see the petroglyphs.
- To provide a range of opportunities/interpretive experiences for all visitors, including children, and to encourage them to see and understand things in different ways. Interpretive opportunities/experiences should be meaningful, enjoyable, and theme-related and should be presented through different facilities, programs, and interpretive media.
- For schoolchildren and other organized groups to participate in theme- and curriculum-related educational activities.
- To provide programs and interpretive messages so that they will be available to all visitors, including visitors with disabilities.
- To provide opportunities for visitors to be aware of ongoing petroglyph and other types of research, which will be information that will contribute to public understanding and ongoing resource protection.
- To enjoy the natural and cultural landscape.
- To provide opportunities for visitors to experience the quiet, sense of solitude, and freedom from intrusions in a relatively natural setting, especially while seeing the petroglyphs.

APPENDIX C: DEVELOPMENT OF ALTERNATIVES

This appendix summarizes the process and information used to develop and revise the alternatives. The alternative development process is the combination of several factors including direction provided by legislation; development of purpose, significance, and interpretive themes; issues and opportunities identified through scoping; resource information and analysis; overall concepts for

visitor use and resource management; and continuing refinement through consultation with a variety of interest groups and agency staffs.

Table C-1 summarizes the basic resource and socioeconomic information that was gathered for the generation of alternatives.

TABLE C-1. RESOURCE INFORMATION

Aerial photographs Areas of geologic interest Areas suitable for development Areas with high noise levels Areas with high research potential	Landscape units Land use
Bird inventory - raptor habitat	Market study of estimated future visitation
Cultural landscape overview	Petroglyph and archeological site locations • integrity and context of petroglyph concentrations • areas with both archeological sites and petroglyphs Places with opportunities for solitude
Drainage patterns — arroyos	Rapid ethnographic assessment
Erosion study Existing conditions — zoning, land use, landownership, utilities, escarpment crossings, disturbed areas and dumping sites	Site analysis of specific areas Slope Soils
Floodplains	Threatened and endangered species — general survey Threatened and endangered species — specific development site survey Traffic impact evaluation Transit system evaluation
General vegetation	Views and visual intrusions Visitor access points
Habitat zones Historical photographs	Wetlands

The planning team used this information and public input to generate initial alternatives based on different overall approaches to visitor use and resource management. Some of the approaches considered were (1) primary access

to the monument from the mesa top, (2) multiple access points from below the escarpment, and (3) limiting access to various portions of the monument for research and resource protection. Concepts of the initial

alternatives were organized and presented in the February 1993 alternatives newsletter.

Below is a description of the alternatives as they were developed beginning in February 1992, why and at what point new alternatives were developed, and why certain elements changed. The various versions of the alternatives are not described in complete detail, nor are maps included for each one. The important defining elements are described.

In February 1992 the National Park Service published a newsletter that included draft purpose and significance statements for the monument and showed three alternatives for resources management and visitor use of the monument. These alternatives designated areas of the monument for varying levels and types of uses and areas where use would be limited to research, American Indian use, and occasional guided tours. One alternative showed a road on the mesa top and a visitor center at the volcanoes, while the others focused use and a visitor center in the southern or middle portions of the monument.

Between February 1993 and October 1993 the planning team considered public comments, collected further resource information, and revised the alternatives. In September 1993 alternatives were developed that included the following — alternative I located a visitor center at the Laurelwood property, which is adjacent to the monument boundary just south of Rinconada Canyon. Visitor contact stations were proposed for Boca Negra and Piedras Marcadas and parking only at Rinconada and the volcanoes. Mesa Prieta was proposed as a remote use area and accessed only by trail from Rinconada Canyon.

In Alternative II the visitor center was at Boca Negra Canyon and focused use in the middle and northern portions of the monument. Rinconada Canyon was accessible only by trail from a parking area on the mesa top at the southern end of the 81st Street. Parking and a visitor contact station was located at Mesa Prieta and Piedras Marcadas Canyon. Alternative III was the no-action alternative and included small parking areas at Piedras Marcadas and Rinconada Canyons, and

continued use of the current visitor center with no established access to Mesa Prieta. Boca Negra Canyon would continue as it currently operates.

In October 1993, just prior to an Advisory Commission meeting in which the alternatives to date were to be presented, the Park Service learned that the landowner was not willing to sell the Laurelwood property. At that meeting the September version of the alternatives was presented, but prefaced by saying that several areas were now being studied to determine the location for the visitor center as described in alternative I. These areas were Lava Shadows, Boca Negra and Rinconada Canyons, Mesa Prieta, and monument lands adjacent to the Laurelwood boundary. The Advisory Commission felt very strongly that one alternative should include a road on the mesa top. A group of three Advisory Commission members met to develop such an alternative that appears as alternative 3 in this document.

Additionally, an NPS landscape architect, architect, and natural resource specialist conducted a study of several visitor center sites. The analysis also identifies the pros and cons of each site including nearness to petroglyphs, soils, drainage, and aesthetics. This information is discussed in more detail in appendix L.

At the request of the Advisory Commission another meeting was held in December 1993 to give the public and advisory commission a chance to see the latest version of the alternatives and to provide additional comment. At this meeting, the revised alternatives and a "sub" alternative of I were presented. Alternative I included a visitor center and environmental education center at Boca Negra Canyon, administration and petroglyph research center at Lava Shadows, visitor contact stations and parking at Piedras Marcadas and Rinconada Canyons, a trailhead and parking at the south end of 81st Street, interpretation and parking at the volcanoes, a visitor contact station at Mesa Prieta, and horse and bicycle trail access through the monument at four locations to connect with trails on open space lands. Horse and bicycle trails connected Boca Negra and Piedras Marcadas Canyons.

Pedestrian-use-only trails were shown in the monument south of the Atrisco grant line. Alternative IA was developed in response to requests by the public to allow horse and bicycle use on the mesa top. Trails were shown on the mesa top and around the volcanoes. All other facilities were the same as described under alternative I. Alternative II located the visitor center and heritage and environmental education center at Lava Shadows.

Administration and the petroglyph research center were located on leased space outside the monument boundary. Visitor contact stations were located at Piedras Marcadas, Mesa Prieta and the 81st Street overlook. No access was provided to the volcanoes. Rinconada Canyon was accessed only by trail from Mesa Prieta or 81st Street. Nonfederal land acquisition would be sought for lands west of the monument boundary between Boca Negra and Piedras Marcadas, and a multiuse trail would be developed on these lands. Alternatives III and IV were similar to alternatives III and IV in this document.

Public comment on these alternatives was generally in support of alternative I. The Greater Albuquerque Trails committee strongly advocated that horse and bicycle use should be allowed to continue on top of the mesa and

wanted multipurpose trails that did not allow motorized vehicles included in the preferred alternative. Friends of the Albuquerque Petroglyphs and Indian community members were generally in favor of alternative 1. Few people spoke in support of supported a road on the mesa top. The Westside Action Council (representing several economic development and neighborhood organizations) presented another alternative that is discussed in more detail under "Alternatives Considered but Rejected." Their alternative included a visitor center west of Piedras Marcadas Canyon, Paseo del Norte passing through the monument, a road on the mesa top and parking areas at Boca Negra Canyon and Mesa Prieta, on the mesa top (2), at the volcanoes (2), at the northern geologic window (1), and on open space lands (1). Pedestrian trails were shown around the volcanoes and in petroglyph concentrations and a multipurpose trail on the mesa top and in the northern and southern geologic windows.

After analysis of public comment, consideration of political realities, and further consultation with the city Open Space Division, the West Side Action Council, and representatives from the environmental and Pueblo community, the alternatives were revised to what appear in this management plan.

APPENDIX D: DISCUSSION OF UNSER BOULEVARD AND PASEO DEL NORTE

Unser Boulevard is segmented into three separate but related corridor study projects.

- Unser South, which runs adjacent to the monument in the Atrisco unit and north from I-40 to Dellyne, has recently been completed.
- Unser Middle, which includes Unser from Dellyne north to Paradise Boulevard as well as Paseo del Norte from Unser east to Golf Course Road, is the subject of a recent environmental impact statement that created considerable controversy. Construction has not yet begun.
- Unser North, from Paradise Boulevard to the Sandoval County line, which is an approved project with designs nearing completion. Construction has not yet begun.

The *Unser Middle Transportation Corridor Study Final Environmental Impact Statement*, (Leedshill-Herkenhoff, Inc. 1992) commonly referred to as the "Unser Middle" project, involves the construction of two principal multilane limited access arterial roadways (Unser Boulevard and Paseo Del Norte), utility lines, bicycle lanes, and recreational trails. The project proposes that both Unser Boulevard and Paseo Del Norte cross the monument. Unser Boulevard, according to City Council Resolution R-455, is to be a limited access four-lane parkway serving as a major arterial street. Paseo del Norte is intended to be a freeway-type facility to serve the northern urban area and complement the interstate system. Paseo is planned to be four lanes, with the potential for future widening to six lanes.

The city began the environmental study process for the Unser Middle Project in 1990. Due to the potential for adverse impacts associated with the roadway project, an environmental impact statement was determined to be the appropriate level of documentation. The stated purpose for the new roadway construction in the Unser Boulevard and Paseo del Norte corridors is to provide improved transportation service on the west side of Albuquerque and to relieve existing and future (using the year 2010 as the base

year) traffic congestion on Coors Boulevard and other area arterials.

The Unser Middle project is not a federal action and does not involve federal assistance, funds, or permits. At the time the EIS process began, the city lands in the Piedras Marcadas and Boca Negra units were not part of the monument. Those lands were added to the monument with the signing of a binding agreement in June 1991 by the city and the National Park Service. The enabling legislation states that all lands added to the monument be managed in accordance with all federal laws generally applicable to units of the national park system, including but not limited to the National Environmental Policy Act (NEPA).

The Unser middle project environmental impact statement (Leedshill-Herkenhoff, Inc. 1992) was not required under NEPA regulations because it is not a federal project and does not require federal permits. However, the Unser Middle environmental impact statement was intended to comply with the spirit and intent of the National Environmental Policy Act and state and Federal Highway Administration environmental impact statement procedures. The National Park Service participated in the environmental impact statement as a cooperating agency but does not agree with the findings of that document.

The *Draft Unser Middle Transportation Corridor Environmental Impact Statement* was released in March 1992. At a public hearing in April 1992, additional alternatives for constructing Paseo Del Norte, which avoided use of the monument lands, were suggested for further evaluation. The city's final environmental impact statement (Leedshill-Herkenhoff, Inc. 1992) evaluated those alternatives, but not to the same level of detail as the original alternatives. The final environmental impact statement found that alternatives to avoid the monument were neither prudent nor feasible because of extraordinary cost and community disruption and that the western alignment for Unser and the middle alignment for Paseo Del Norte was the alternative of least harm. In

approving the environmental impact statement, the City Council did not authorize the expenditure of land acquisition and design and development funds until a letter was received from the city attorney stating that there were no credible legal barriers to constructing the road through the monument. In spite of the opposition to the proposed project and questions concerning the legal authority to construct Paseo Del Norte through the monument, a record of decision was issued in December 1993 and concluded the city's environmental impact statement process.

The National Park Service has determined that Unser Boulevard could be constructed along the gas line right-of-way in a way that is consistent with protection of monument resources and purpose. The construction of Unser Boulevard along the gas line alignment would reduce the noise and visual impacts that the current two-lane road now causes on Boca Negra Canyon; thus, a monument purpose for Unser Boulevard may be served.

No such argument for Paseo Del Norte can be made. The construction of and use of Paseo Del Norte would adversely impact the cultural and natural resources for which the monument was established. Construction of a major four-to six-lane arterial roadway would effectively sever the Piedras Marcadas unit from the rest of the monument. Access to the Piedras Marcadas Canyon would be significantly reduced to auxiliary access through local subdivisions. Visitors choosing to hike the length of the escarpment would not be able to do so uninterrupted by vehicular traffic. No vehicular road currently crosses the escarpment in the vicinity, and the impact of a new 50 mph roadway would greatly decrease the overall quality of the visitor experience in areas adjacent to the road.

Seeing the petroglyphs in as close to their original context as possible helps visitors to understand and consequently respect the significance of the petroglyphs and associated archeological sites. This would not be possible adjacent to an elevated freeway. It is important to provide a sense of solitude when seeing the petroglyphs and to provide opportunities to hear interpreters who are giving guided tours. Noise generated from vehicles on Paseo Del Norte would dramatically increase the noise levels in the immediate vicinity of a large petroglyph concentration. Visitors to the 800+ petroglyphs in the area would be distracted by the constant traffic and the resulting noise and visual intrusion.

Constructing the road would require that some petroglyphs would need to be relocated or buried. The integrity of the continuous volcanic escarpment, one element in the nomination of the Las Imagines Archeological District, would be broken. American Indians have identified these lands as significant to them and their continued spiritual practices. The introduction of a "freeway type facility" would significantly impact their use of the area. A 50 mph freeway-type road does not meet monument purposes. Therefore, the management plan assumes that Unser Boulevard, as a four-lane parkway, would be built but that but that Paseo Del Norte would not be constructed through the monument.

Although the National Park Service has determined that there is no authority and no monument purpose for Paseo del Norte within the monument, this road corridor is still under consideration by the city and unresolved issues about the road remain. Therefore, the road alignment will be shown on monument alternative planning maps as the "Paseo del Norte study corridor."

APPENDIX E: RELATED PLANS AND DOCUMENTS

"Planned Communities Criteria: Policy Element" (City of Albuquerque 1991) — Contains criteria for the adoption of other smaller-scale plans in the undeveloped or sparsely developed portions of Bernalillo County. Concepts include development standards and criteria that would identify and conserve environmental resources and provide the city with a basis to handle large-scale and or noncontiguous development.

Trails and Bikeways Facility Plan (City of Albuquerque 1993d) — This plan proposes a multiuse trail system for recreational and transportation trails, recommends development standards, specifies trail locations, and sets priorities for the use of public funds. Specific trails planned within the boundaries of Petroglyph National Monument were removed from the proposed trails map in this plan. Proposed trails outside the monument boundary run beside Unser Boulevard, the San Antonio arroyo, in Santa Fe Village at the base of the escarpment. Escarpment crossing occur at the Boca Negra Canyon and Paseo Del Norte alignments, and south along 81st Street.

Bosque Action Plan (City of Albuquerque 1993a) — This plan identifies goals, policies, and projects to ensure the survival of the Rio Grande Bosque and to provide a unique recreational and educational experience for the public. Policies address the environment/wildlife, recreation and other public use, education, and administration. The Bosque is 1-2 miles east of the monument.

Bikeways Master Plan (City of Albuquerque 1992) — This plan identifies bicycle facilities, including specifically designed bicycle trails and bicycle lanes. Updated by the Urban Transportation Planning Policy Board, the plan identifies bicycle facilities along Unser and Paseo Del Norte.

Draft Open Space Facilities Plan (Southwest Land Research, Inc. 1994) — Currently in draft form, this plan establishes guidelines for the implementing the open space goals in the *Albuquerque/Bernalillo County Comprehensive*

Plan. Open space is considered relatively undeveloped land dedicated to passive and active uses not accommodated by the parks system. The open space system provides visual relief from urbanization and offers opportunities for education, recreation, cultural activities, and conservation of natural resources. The volcanoes, mesa-top lands, and escarpment were acquired for open space. Approximately 3,000 acres of land within the boundaries of Petroglyph National Monument are currently managed by the Albuquerque Division of Open Space. This plan identifies appropriate uses and management techniques for the different types of open space lands; it does not address open space lands within the monument. A draft document is expected in fall 1994.

Facility Plan for Arroyos (City of Albuquerque 1986) — This plan recognizes that Albuquerque's arroyos serve multiple purposes — such as drainage, major open space, links between open space lands, and a basis for urban trails. The San Antonio, Boca Negra, and Piedras Marcadas arroyos are identified as part of the recreational arroyo network.

Draft West Side Strategic Plan (Consensus Planning, Inc., in preparation, 1994) — The purpose of this plan is to review existing plans and policies that address the city's west side, identify infrastructure needs and available resources, and target infrastructure priorities on the west site. It is expected that this plan will result in planning strategies that guide and integrate the diverse needs of the west side.

Long Range Major Street Plan (Middle Rio Grande Council of Governments 1993) — This plan addresses the future development of the major street system for the Greater Albuquerque urban area. The plan, which is updated yearly, proposes roads ranging from limited access principal arterials to collector streets. The plan contains policies on the functional classification of streets, rights-of-way, location study corridors (where proposed alignments have not been established but are under

consideration), and access limitations. Proposed principal arterials that have an impact on the monument include the Paseo del Norte extension, Unser Boulevard extension, Paseo del Vulcan extension, and the extension of 20th Street from the Sandoval County line north into Rio Rancho. Other location study corridors with possible impacts on the monument include the Ladera Irving, Westside-McMahon extensions to the Paseo del Vulcan extension, Rainbow Boulevard northern and southern extensions, 20th Street northern extension to Northwest Loop, and the Northwest Loop.

Volcano Cliffs Conceptual Sector Development Plan (Flatow Moore et al. 1982) — A master plan for Volcano Cliffs was prepared, and the subdivision directly north of the monument on the mesa top was platted in the mid 1960s. The master sector plan was never approved. In 1993 the city Planning Department conducted a fiscal impact analysis for Volcano Cliffs, which evaluated the expected costs, both public and private, of developing the area.

Black Ranch: A Planned Community Master Plan (A. Wayne Smith & Assoc. 1990) — Black Ranch is a planned community containing approximately 6,700 acres north and west of Double Eagle II Airport, the volcanos, and the northern geologic window. The planned community has the potential to support a population of over 40,000. Access to Black Ranch may impact roads adjacent to and through the monument. The Bernalillo County Commission approved the master plan in 1990.

Draft Paseo Del Vulcan Corridor Study (Avid Engineering Inc. 1994) — The Paseo del Vulcan transportation corridor is directly west of the monument boundary and is currently under study by the State Highway and Transportation Department. Paseo Del Vulcan is intended to be a six-lane, high-capacity, limited access roadway extending north and east from I-40 and connecting with I-25. Preliminary planning and evaluation for this roadway is currently underway, and it has not been determined as to whether the road will be west of Double Eagle II Airport or between the airport and Petroglyph National Monument. Impacts on the monument will be evaluated as part of the state's study.

Sector Plans — Sector plans provide general land use and specific zoning, including densities for a designated area. They also identify transportation and trail networks as well as park and open space requirements. Several sector plans have been developed for lands near the monument. These include the *Riverview Sector Plan* (Community Sciences Corp. 1986) (west of Coors Boulevard and north of Montañito), the *Double Eagle II Sector Plan* (Greiner Engineering, Inc. 1989a and b), the *Coors Corridor Plan* (from Central to NM 528) (City of Albuquerque 1984), the *Seven Bar Ranch Sector Plan* (Denish 1981, revised 1985), the *Lava Shadows Sector Plan* (Johnson 1984), *Draft Calabacillas Arroyo Corridor Plan* (City of Albuquerque 1989), and *Draft San Antonio Arroyo Corridor Plan* (Resource Technologies, Inc. 1988).

Drainage Master Plans — Several plans and studies concerning drainage in and around the monument have been or are being developed and approved. Among them are the *Far Northwest Drainage Management Plan* (Bohannon-Huston, Inc. 1986) defining the 100-year stormwater flows for the Westgate, Ladera, San Antonio, Boca Negra, and Mariposa watersheds), the *Draft Northwest Mesa Drainage Management Plan* (Scanlon and Assoc. 1989) evaluating and making recommendations for passing developed condition peak stormwater flows generated within the Ladera, San Antonio, Boca Negra, and Mariposa watersheds into the Rio Grande), and the *Piedras Marcadas Drainage Management Alternatives* (Easterling & Assoc. Inc. 1989c) identifying strategies for addressing runoff from existing and future westside development and determining ways to convey runoff through Petroglyph National Monument). Other drainage management plans include the *Black Ranch Drainage Management Plan* (Easterling and Associates 1989a), the *North Coors Drainage Management Plan* (Canton & Associates 1985), the *Piedras Marcadas Basin Drainage Management Plan* (Mann and Associates, Inc. 1983), and the *Draft Calabacillas Arroyo Corridor Plan* (City of Albuquerque 1989).

Capital Improvement Program (City of Albuquerque 1993b) — The *Capital Improvement Program* for the city of Albuquerque provides

for the purchase, rehabilitation, or development of property or systems to enhance the physical development of the city. The plan may be used to acquire and protect lands proposed as major open space and for

Petroglyph National Monument. Easements for access, trails, and buffers may be purchased. CIP planning spans a 10-year horizon, with biennial review.

APPENDIX F: NPS ARCHEOLOGICAL SITE POLICY

Excavation of the Piedras Marcadas Pueblo ruin is not recommended at this time because "according to National Park Service management policy, significant archeological resources [will] remain preserved *in situ* whenever possible." (NPS *Management Policies*, V:1-2 and NPS 28).

The Park Service recognizes that monument and public needs for development and interpretation as well as environmental processes may, upon occasion, dictate the alteration or destruction of cultural resources. NPS policies contain provisions for these adverse affects when there is an "overriding research, interpretation, site protection, or park development need" (emphasis added; Draft NPS 28).

The decision to excavate or stabilize archeological ruins or sites can only be made if all the following criteria are met (from NPS *Management Policies*):

The action is consistent with the park's purposes and applicable NPS policies and guidelines.

Cultural resource specialists have participated in planning, and sufficient data have been gathered to assess the probable effects.

Relevant sections of the National Historic Preservation Act have been complied with in accordance with the regulations of the Advisory Council on Historic Preservation (36 CFR 800) and the "Guidelines for

Federal Responsibilities under Section 110 of the National Historic Preservation Act" (FR 53:4728).

In cases involving ethnographic resources, associated American Indian and other ethnic groups have been consulted, and their concerns have been taken into account.

Historic and prehistoric burial areas, whether or not formally plotted and enclosed as cemeteries, will be identified and protected. They will not be disturbed or archaeologically investigated unless threatened with destruction by park development, operational activities, or natural forces.

The NPS policies regarding excavation have been established to ensure the preservation of sites for future research. Excavation would recover information but the excavation process would destroy the ability recover further information as new techniques are developed.

The cost of excavating and stabilizing an adobe ruin would be substantial. The adobe walls would require considerable restoration and continued upkeep. Curating and storing site artifacts would represent a major investment of time and funds, which would continue into the future.

Human remains have been reported by workers at the site. If human remains are found, there must be compliance with the Native American Graves Protection and Repatriation Act (PL 101-601) and NPS policy.

APPENDIX G: DETAILED EXPLANATION OF THE CULTURAL LANDSCAPE

Through the *Cultural Landscape Overview* (NPS 1994a), done especially for this planning process, the National Park Service looked carefully at the monument's cultural landscape to ensure that these cultural resources would not be adversely impacted by proposed development. Because criteria that help define a cultural landscape are linked to National Register of Historic Places determinations, Petroglyph National Monument may include several potentially significant cultural landscapes. The final cultural landscape overview report includes determination of eligibility nomination forms for the identified landscapes.

Actually there are many types of cultural landscapes, as defined in NPS 28. Most of the monument's landscape and resources have significance and value with regard to aesthetic, scientific, educational, religious, and cultural considerations, and the following four types of potentially significant cultural landscapes were defined in the overview as represented in the monument:

- (1) prehistoric vernacular component¹ landscape — representing the time period from roughly 6,500 B.C. to A.D. 1540.
- (2) historic vernacular component landscape — representing the Atrisco land grant and its continuum of use by the descendants of the original grantees. The time period associated with this landscape ranges from A.D. 1692 to A.D. 1944.
- (3) historic designed component landscape — representing land use practices in the open

space lands associated with the city. The time period associated with this landscape ranges from A.D. 1710 to A.D. 1944.

- (4) ethnographic landscape — representing the contemporary traditional land use practices of both the Pueblo and Atrisco land grant heir groups maintaining an association with the west mesa area. Features or areas of this landscape hold special religious meaning for Pueblo peoples.

The *Cultural Landscape Overview* recommended the prehistoric and historic vernacular landscapes as nationally significant under national register criteria. These landscapes have retained their integrity, particularly in the areas of setting, location, association, and community organization. The historic designed landscape may be significant, but further study is needed before a recommendation can be made. The features of the ethnographic landscape need to be identified by the various contemporary groups who have maintained traditional associations with and uses of this landscape. Further ethnographic studies relating to identification of traditional cultural properties are recommended (see the list of further studies needed in the "Cultural Resource Management" section under "Actions Common to All Alternatives"). Such studies would include inquiries regarding features of the ethnographic landscape, the contemporary needs of its traditional user groups, and the sacred values these landscape features and resources hold for tribes.

1 Component cultural landscapes have been defined by the NPS servicerwide Cultural Landscape Inventory Program as "a landscape unit which contributes to the significance of a landscape and itself can be further subdivided into individual features. The Component Landscape may contribute to the significance of a National Register property or, in some cases, be individually eligible for the National Register of Historic Places."

APPENDIX H: FURTHER CULTURAL AND NATURAL RESOURCE STUDIES/PLANS NEEDED

TABLE H-1. FURTHER CULTURAL AND NATURAL RESOURCE STUDIES/PLANS NEEDED

FUTURE STUDIES NEEDED	STUDY COMPONENTS
CULTURAL RESOURCE RELATED STUDIES	
Archeological inventories	Cover previously unsurveyed or poorly documented areas, including an evaluation of site significance and integrity.
Petroglyph inventories	Same as above.
Petroglyph/archeological site damage assessment survey	Document existing damage, potential vulnerability, and threats.
Archeological overview and assessment	- Consolidate, review, summarize, and evaluate existing archeological data. - Identify data gaps and research needs.
Archeological evaluation study	Evaluate archeological properties for national register eligibility (to be completed where such evaluations were not made as part of ongoing inventories).
Site monitoring program	Monitor petroglyphs and other archeological sites for damage indicators, thresholds, and types of monitoring needed.
Data recovery plans/mitigation reports	- Provide context and method to guide data recovery. - Recover data from sites that face imminent destruction from natural processes or vandalism.
Restoration/conservation plan for petroglyphs and other rock surfaces	- Prioritize graffiti removal and repair of rock surfaces. - Identify testing procedures, techniques, materials, and professional expertise needed to restore damaged petroglyphs.
Piedras Marcadas Pueblo ruin management plan	In cooperation with the Pueblo community, this study would: - Address potential development and management of the ruin. - Develop protection strategies. - Develop research design(s).
Research design (archeological sites including petroglyphs)	Guide and prioritize further archeological work in monument — e.g., examine relationships among petroglyphs, archeological sites, and cultural landscapes.
Research on Rio Grande style petroglyphs	See text for description of research.
Scope of collections statement	Define purpose, extent, and uses of monument collections.

TABLE H-1. FURTHER CULTURAL AND NATURAL RESOURCE STUDIES/PLANS NEEDED (CONT.)

FUTURE STUDIES NEEDED	STUDY COMPONENTS
CULTURAL RESOURCE RELATED STUDIES (cont.)	
Collections storage plan/collections management plan	• Identify acceptable options for management and care of collections. • With scope of collection statement, provide a consistent approach among the partners to manage archeological artifacts, museum objects, records of petroglyphs, and natural resource specimens.
Cultural landscape report	• Continue work begun in cultural landscape overview. • Complete evaluation of the landscape for its national register values, integrity, and significance. • Include recommendations for long-term management of the landscape. • Include more specific inventory and analysis of the ethnographic landscape.
Study to identify traditional cultural properties and traditional use	• Identify and describe plants and other resources within the monument traditionally used by American Indian and Atrisco land grant heir groups affiliated with the monument. • Where groups are interested in sharing information to help protect sites, acquire general information regarding areas of religious sensitivity. • Provide support data for cultural landscape report.
Comprehensive American Indian consultation plan	• Provide protocol for consultation (including implementation of American Indian Religious Freedom Act and Native American Graves Protection and Repatriation Act provisions, proposed development or decisions that would affect ethnographic sites and accidental discovery of burials or other sacred sites).
Cooperative ethnohistory program	• Monument staff, American Indian, and/or Atrisco heirs cooperate to record the monument's ethnohistory. • Through cooperative ventures with these groups, produce up-to-date ethnographic data on the uses of plants and other resources. • Provide information essential for preparation of the monument's cultural landscape report.
Native American Graves Protection and Repatriation Act implementation plan	• Strategies to ensure discussions with American Indians regarding archeological investigations and inadvertent discoveries
Petroglyph protection program	• Develop a public education program aimed at protection of petroglyphs.

TABLE H-1. FURTHER CULTURAL AND NATURAL RESOURCE STUDIES/PLANS NEEDED (CONT.)

FUTURE STUDIES NEEDED	STUDY COMPONENTS
NATURAL RESOURCE RELATED STUDIES	
Monitor and evaluate stormwater runoff and erosion	• Monitor existing gullies, establish methods for measuring stormwater runoff • Identify resource threats
Develop and calibrate a runoff model for the monument using historic and present-day flows	• Develop in cooperation with the city, private sector developers, and the Albuquerque Metropolitan Arroyo Flood Control Authority. • Provide data needed to evaluate requests for drainage across monument lands. (As development of lands continues adjacent to the monument, the monument will continue to receive these requests. Each request will be considered on a case by case basis and may require an environmental assessment or impact statement.)
Conduct a study to identify petroglyphs and other cultural resources that are threatened by natural processes, including erosion	
Inventory and monitor biotic resources	• Identify plant and animal species and communities • Develop long-term monitoring program
Revegetation and restoration of disturbed areas	• Inventory and prioritize areas for restoration • Evaluate native, indigenous species for use in monument • Develop restoration plans for specific sites
Fire management plan	• Research fire history and role of fire in Chihuahuan grassland
Cave management plan	• Evaluate cave resources and management needs
Raptor protection study	• Monitor raptor use in the monument • Identify management strategies for their protection.
Noise monitoring and evaluation	• Monitor and evaluate ambient noise levels and intrusions from adjacent development
Identification of indicators to measure carrying capacity	• Identify resource and social indicators that can be easily measured in the field for use in identifying carrying capacity for the monument.
Trail plan	• Detailed site designs for trail improvement.
Development concept plans	• Detailed site designs for development sites. Development concept plan maps in this document are intended to eliminate the need for further development concept planning at those sites; other sites would require development concept plans.

NOTE: To maximize resource protection, natural resource studies would be integrated with multidisciplinary cultural resource studies such as the cultural landscape report.

APPENDIX I: GENERAL DESIGN GUIDELINES

INTRODUCTION

The beauty and deeply rooted cultural heritage of the monument's landscape should be complemented by a built environment (roads, trails, and other facilities) that directs the visitor's attention toward the monument's resources and away from the intrusive urban development encroaching upon the area. The goal of these guidelines is to encourage this attention with design consistency and visual quality that communicate a sense of place, including imitation of natural landscape patterns in developed areas and minimal disturbance of ecological and cultural resources during design, construction, and maintenance.

Site development and landscaping, including walkways and visitor contact areas, should be subtle and not dominate the surrounding landscape. Design should effectively link the natural and built forms by harmonizing the patterns and biotic diversities found in the landscape with the form, mass, scale, color, and textures of facilities. Visitor facilities should also reinforce interpretive themes and messages. Instilling a sense of respect and appreciation of the cultural and natural resources is an important interpretive concept that can be addressed with appropriate and subtle design elements. For example, siting trails at a minimum distance from petroglyphs can help instruct visitors to view the rock images at a respectful distance and prevent damaging the resource.

The following is a series of guidelines developed to consider in the preparation of designs for park facilities.

SUMMARY OF DESIGN GUIDELINES

Planning Background and Design Values

Before the development of these guidelines, a workshop was conducted to identify visitor experience goals. Conclusions made in the workshop became the foundation for the design guideline development. Once the visitor

experience is understood, appropriate design direction for facilities can be developed. The primary goals identified in the workshop were to provide opportunities for visitors to

- respect, experience, learn about, and appreciate the cultures associated with the cultural and natural landscape of the monument
- view and appreciate petroglyphs in a variety of appropriate settings and situations
- cooperate with the preservation of cultural and natural resources
- understand primary interpretive themes

Throughout the discussions in the workshop, key elements were addressed and identified as important considerations of the planning and design of visitor facilities. These elements, which should be incorporated in design, include the following:

- **Spiritual/Respectful** — These two values are so closely related that combining them into one category seemed appropriate. They both entail creating a setting to encourage visitors to feel contemplative, accepting, and perhaps even inspired by the natural and cultural resources of the monument. Because the monument was established to recognize the spiritual heritage of the culture that created the petroglyphs, these values are of particular significance to planning and design of the monument facilities.
- **Organic** — An organic development should be nestled into the topography and blend into the landscape as if growing out of the ground. Lines and shapes are contoured and continuous. Contrast is not an aspect of organic design.
- **Unobtrusive** — Incorporating this value into the design of facilities for the monument would result in a development that avoids competition with the resource. Subdued and blending in are key phrases to express this

value. An emphasis on this value would encourage visitors to focus on the resources and not visitor facilities.

- Decompression — The value of decompression is the process of transforming visitors experiences from the traveled urban environment to the quieter more contemplative environment of the monument.
- Comfort — The premise of this value is to provide physical as well as psychological comfort at visitor facilities. Psychological comfort would include such aspects as assurance, feelings of ease, lack of confusion, clearly defined areas, subtle transitions, easy choices, and spaciousness.
- Indigenous — Indigenous architecture in this region includes American Indian and Hispanic American architecture.

Circulation and Sequence

1. A planned sequence of experiences should be integrated into the circulation throughout the facilities.
 - Visitors should be guided from the urban environment surrounding the monument to the petroglyph concentrations with a sequence of gradual and distinctive spaces and experiences to prepare them for an increasingly contemplative focus.
 - A gateway should be incorporated to provide a subtle transition from the urban environment to a special place.
 - Circulation should be clear and easy, with not many choices. Visitors should be guided into the site — from roads to trails to the resource.
2. Parking should be located within a reasonable distance to resources and facilities to ensure universal accessibility.
3. The natural topography and vegetation should be integrated into the parking areas.

- Terraced parking and islands of native vegetation screens are two examples of achieving this guideline.

- Roads, trails, and parking areas should follow natural topography and landforms.

4. Meandering routes with frequent stopping and resting areas should be considered.
5. Roads and trails should be oriented to focus on views that may inspire or provide a larger contextual background.
 - Mountain and petroglyph views should be emphasized along routes.
6. Promote quiet and contemplative areas close to petroglyphs.
 - Trails close to petroglyphs should be narrow to discourage distractions from conversations and talking.
7. Trails should be well defined to discourage visitors from getting too close to rocks with petroglyphs.
 - Edges along trails should be defined.
8. Trail surfaces close to petroglyph concentrations should have soft, quiet, and distinctive surfaces.

Architectural Character

9. The architectural character should emphasize warmth and a welcoming atmosphere.
 - Colors should be warm, and materials should generate warmth.
 - A sense of entering a homelike environment should be created.
10. Structures should reflect the curvilinear, contoured environment.

11. Structures should integrate indoor and outdoor spaces, which could be done through various means, including creating a visual connection between the outside and the inside and allowing outdoor features to continue into the inside.
12. The scale of the development should take the resource into consideration.
 - Clustering and breaking up building masses would be appropriate.
 - Building mass should be low to the ground.
13. Colors and materials should be compatible with the surrounding landscape.
 - Bright colors and reflective materials would be inappropriate. Native materials would be appropriate.
14. A kiva-like space should be incorporated for storytelling, music, or other audio messages.
15. A zoning scheme should be created to separate visitor comfort, orientation, and other services from the contemplative, interpretive areas.
16. The human scale of space should be emphasized.
17. Multisensory experiences should be integrated to inspire a variety of moods. Ideas to consider should include use of light and dark spaces, locating aromatic herbs close to use areas, including ceremonial gestures, such as a fire ring and music, in interpretive programs, and using inspirational audio messages.
18. A stage-like setting should be created for visitors to participate in the experience of discovering the significance of the monument's resources on their own.
19. Variations of height and space or moving from an open environment to a more enclosed environment should be used. This includes changes in the quality of light or

from bright to more subdued light. Rhythms of spaces create decompression and progression.

20. Materials can change from hard and reflective to softer, more organic materials.

Design characteristics that reflect indigenous architecture should be incorporated, including the following:

American Indian

- local materials, including mud, plaster, stone, and adobe
- materials that are reflective of the adjacent natural spaces, i.e., the cliffs
- multilevel or low profile materials
- flat roofs of logs, thatching, and dirt, which may also be used as decks
- shade structures or ramadas constructed of logs
- irregular massing with modular additions of rectangular rooms; circular spaces reflect spiritual significance
- contiguous additions of small rooms
- punched window openings
- multiple entries from a plaza or rooftop
- use of fireplace or ovens
- complex water drainage and storage systems
- funnel-like entrances to subsurface areas (such as used in pithouses)
- constructed near rivers, at the bases of cliffs; pit houses were frequently built on high ground
- handcrafted features

Hispanic American

- courtyards, container gardens, water features,
- materials are adobe, jacal (vertical logs for storage buildings)
- contiguous rooms around courtyard with a zaguan or large gate
- low profile
- use of portals and open porches
- punched window openings
- garden walls
- access from plaza
- earth or plank floors

- handcrafted features such as carved doors, corbels, and zapatas or wooden braces
- protruding elements such as extended vigas or wood logs

Landscape

21. Visitor areas should be screened from the surrounding urban environment.
22. Natural areas between facilities should be retained. For example, parking areas and buildings should be separated with the existing native environment to help connect architecture with the landscape.
23. Development should be concentrated in disturbed areas.
24. Views to resource features should be preserved and enhanced.
25. Facilities should be sited judiciously to avoid impacting views of the resources; this is of critical importance.
26. All development should be minimally intrusive.
27. The natural environment should be integrated with the built environment to encourage respect for natural processes. This might include integrating the outdoors with the indoors, framing views, using native vegetation, allowing surface drainage, and avoiding underground drainage structures.

Information

28. Signs should have a low profile.
29. Low-volume sounds such as splashing or running water and music should be used.

30. Formal exhibits should be used only in orientation areas.
31. Suggestive, evocative interpretive and exhibit devices should be used. Storytelling, music, views, and display of objects should be done in simple and solitary settings to emphasize importance of each item (like an altar).

FACILITY SIZE AND FUNCTION (BUILDING AND PARKING NEEDS)

The major monument facilities were sized to determine the area needs and functional relationships. The major facilities include monument administration, visitor center, petroglyph research center, heritage education facility, and parking for each of the four functional facilities. Table I-1 below summarizes the approximate square footage needs for the buildings.

Parking needs were based on projected annual visitation of 250,000 annually (see appendix O). The greater percentage of visitors (85% used for calculation purposes) arrive between April and October. Visitors would spend about an hour at the visitor center and arrive mostly by private car. Therefore, approximately 1,020 visitors per day and approximately 128 visitors per hour could be expected. Based on these numbers, a parking area to accommodate 55 cars and 15 oversize vehicles (buses, RVs, etc.) would be required for the visitor center. Parking for the administrative facility is based on the number of staff and totals 30 car spaces. The heritage education facility would require two bus parking spaces and 10 car spaces for staff and other visitors.

TABLE I-1. SUMMARY OF APPROXIMATE SQUARE FOOTAGE REQUIREMENTS

Function	Square Feet
Administration	6,100
Maintenance	6,400
Petroglyph Research Center	1,300
Visitor Center	9,500
Subtotal	23,300
Heritage Education Center	6,500
Total	29,800

TABLE I-2. ADMINISTRATION/HEADQUARTERS

	Square Feet
Offices (see breakdown sheets)	3,220
Conference Room	300
Darkroom and Storage	200
Break Room	250
Kitchen	100
Lockers (staff)	100
General Office Storage	100
Loading/Receiving Area	150
Toilets	450
Net Total	4,870
25% 10% walls, 10% circulation, and 5% service (mech., elec., phone, etc.)	6,088
Gross Total	6,088*
	(6,100*) use

*Includes all interpretive spaces and functions

**Without interpretive division

Breakdown of Offices (in administration headquarters)

Area/Function	Net Square Feet
Superintendent Area	
• Waiting	100
• Secretary	100
• Office	200
	400

		Square Feet
Administration		
• General Clerk	80	
• Personnel Assistant	80	
• Purchasing Agent	100	
• Administrative Officer	120	
		380
Division Chief's Office		
• External Affairs	120	
• Visitor Protection and Natural Resources	120	
• Maintenance	120	
• Interpretation and Cultural Resources	120	
		480
Subtotal		1,260
Division of Visitor Protection Natural Resources Management *		
♦ Clerk Typist	80	
♦ Patrol Operations		
• Ranger Office	100	
• Workroom for five rangers	200	
		380
♦ Natural Resources Management		
• Resource Management Spec. Office	100	
• Biological Technical Office	80	
		180
Subtotal		560
Division of Maintenance *		
♦ Project Clerk	80	
♦ Custodian's Office	100	
♦ Trails Office	100	
♦ Workroom for nine staff	360	
		640
Subtotal		640
Division of Interpretation and Cultural Resources Mgmt. *		
♦ Clerk Typist	80	
♦ Outreach Operations		
• Outreach Coordinator's Office	100	
♦ Interpretive Operations		
• Interpretive Specialist's Office	100	
♦ Cultural Resources Management		
• Specialists Office	100	
• Curator's Office	100	
♦ Workroom for seven staff	280	
		680
Subtotal		760
* Does not include space for seasonal position (number undetermined at this time)		
Note: Gross = 760 + 25% = 950 (1,000) use		
OFFICES GRAND TOTAL		3,320

Maintenance Facility		Square Fee
♦ 2 garage bays		6,400
shop		
storage		
Petroglyph Research Center		
Offices		
• Assistant	100	
• Director	150	
		250
Workroom for 3-5 visiting researchers	400	
General Storage	300	
Restrooms (provided elsewhere)		
Net Total		950
+25%		238
GROSS TOTAL		1,188
		(1,200) use

Library and Curatorial		
Library		
Curatorial		
• Work Space	250	
• Storage	400	
		650
Net Total		1,050
+25%		263
GROSS TOTAL		1,313
		(1,325) use

Visitor Center		
Public Circulation		
• Entry/Vestibule	150	
• Lobby (to accommodate 40)	600	
• Seating Areas	200	
		950
Visitor Contact		
• Information Desk	200	
• Office (adjacent)	100	
		300
Exhibit Room	1,600	
Audiovisual		
• Seating for 100	1,000	
• Projection Room	150	
		1,150

	Square Fee
Multipurpose Room (for 40)	600
Demonstration/Storytelling Area	500
Reading Area	400
Book Sales	
• Display	250
• Storage	150
• Office	100
	500
First Aid Room	100
General Storage Room	250
Toilets (visitor and staff)	1,200
(includes janitor closet and unisex)	
Net Total	7,550
+25%	1,888
GROSS TOTAL	9,438
	(9,500) use

Heritage Education Center

Activity Rooms (4) for	1,500
80 Students	
20 Adults	
(A/V programs plus storage @ each activity room)	
Toilets (visitors and staff)	600
Lunchroom	
• Eating Area	2,000
• Kitchen/Serving Area	400
	2,400
Staff	
• Lobby	150
• Reception	100
• Director's Office	150
• Workroom for 8 staff	320
	720
Net Total	5,220
+25%	1,305
GROSS TOTAL	6,525
	(6,500) use

APPENDIX J: DETAILED DISCUSSION OF BOUNDARY ADJUSTMENT AREAS

CRITERIA

In accordance with NPS *Management Policies*, PL 101-628, sections 1216 and 1217, the criteria necessary for the boundary adjustment areas are as follows:

1. To include significant resources or opportunities for public enjoyment related to purposes of the park.
2. To address operational and management issues such as access and boundary identification by topographic or other natural features or roads.
3. To protect park resources critical to fulfilling the park's purposes.
4. To be feasible to administer in terms of size, configuration, ownership, costs, and other factors.
5. To ensure that other alternatives for management and resource protection are not adequate.

DISCUSSION AND APPLICATION OF CRITERIA

Additional Boundary Adjustment Area, Alternative 1. These five lots have been recommended for addition to the monument because of the potential that they will be developed in a fashion incompatible with adjacent monument uses. The city has zoned these lots O-1 Office and Institutional Zone. In this zone, permitted uses include offices, beauty/barber shops, churches, medical supply and services offices, photocopy stores, photographic studios, and public utility structures such as transformers, pumping stations, and electrical switching stations.

Each of the alternatives envisions the development of facilities within the former state park area, which is adjacent to this potential boundary addition. Much of the area suitable for building facilities within the state park area and the land within boundary adjustment area 1 slope toward one another. It would be extremely difficult to minimize the visual impact of any development placed

within the boundary adjustment area from visitors to the state park.

The addition of these lands to the monument would create a more identifiable boundary. Mojave Street is a fairly substantial roadway; a boundary along its northern edge versus behind office buildings or similar facilities would be much easier for visitors to identify. Adding these lands to the monument would be feasible to administer in terms of size, configuration, ownership, and cost. The only other feasible means to protect these lands would be to modify the existing zoning (and concurrent change in proposed land use). The change in zoning to more compatible uses such as public parks, open space, or very low density residential is not likely. Accordingly, these properties should be added to the monument.

Single-Family House and Lot, All

Alternatives. This property is at the end of Creggs Street at the northern edge of the Atrisco unit. The property is less than 1/3 acre in size and includes a single-family residence. The inclusion of this property within the existing authorized boundary was an oversight in the initial boundary mapping process.

This property does not include significant resources or opportunities for the public to further enjoy monument resources. It is the last house on a street with seven houses abutting the monument. This one residential property does not aid in identifying the monument or fulfill any monument purpose. Accordingly, this property should be removed from the monument boundary.

Volcano Cliffs Units 2 and 5, All Alternatives.

In drawing the existing monument boundary, a portion of Rim Rock Drive and lots on either side of this roadway were included within the monument. The closure of Rim Rock Drive as envisioned by each of the alternatives would eliminate access to approximately 54 lots in the Volcano Cliffs community. Some of these lots must be acquired to provide access. The National Park Service will work with affected

side of this roadway were included within the monument. The closure of Rim Rock Drive as envisioned by each of the alternatives would eliminate access to approximately 54 lots in the Volcano Cliffs community. Some of these lots must be acquired to provide access. The National Park Service will work with affected landowners, the Volcano Cliffs Property Owners Association, and the city to ensure that access will be provided to these lots. Given several alternatives and the need to bring various parties together, it is premature to recommend a specific solution or adjustment at this time.

Volcano Cliffs, Units 2 and 5 and Part of 24, All Alternatives

This adjustment area includes 289 lots within Volcano Cliffs subdivision Units #2, #5, and a portion of #24. This mesa-top land is a visual extension of the monument and open space lands with the same open space, long-distance views, high desert vegetation, and wildlife habitat resource values. Unlike the adjacent open space lands, gravel roads have been developed throughout the property as part of the subdivision process in 1966 and 1967. This area provides opportunities for visitors to enjoy the expansive views of the Rio Grande Valley and the Sandias to the east as well as the broad, undeveloped mesa top and volcanoes. The area also provides good opportunities for picnic facilities that would not have adverse impacts on monument resources.

When and if utilities are provided to this area, the private lands will be developed as single-family housing. Single-family housing on this site would separate the monument from the Open Space lands and could require additional utility crossings (water, sewer, and storm water) of the escarpment. Development of the area would increase the risk of resource damage because of nearby residences.

Inclusion of this area within the monument would provide substantial opportunities for visitors to enjoy distant views east and west relatively unimpaired by development. Conversely, should the property be developed as

currently zoned, visitors would have restricted views and they would be faced with having visually intrusive development separate existing monument lands from open space lands to the west. There is nothing to distinguish these lands from existing monument and open space lands except the relatively nonintrusive gravel roads that have already been built (but which could easily be revegetated).

The addition of these lands to the monument is feasible in terms of size and configuration. Ownership is similar to other areas of Volcano Cliffs currently within the monument boundary — mostly .3- to .4-acre parcels. Overall cost of this acquisition would be approximately \$4.5 million.

The Volcano Cliffs subdivision was platted in 1967, but there has been no residential or commercial development to date. Generally, this is attributed to the lack of utilities. With the proposed extension of Unser Boulevard, there is some potential that this area will develop relatively rapidly. However, a recent fiscal impact analysis by the city indicates that the cost of utility/infrastructure expansion to this area may be substantially more expensive than in other areas of the city. The city's costs for providing infrastructure are estimated to be \$10,000 per lot or approximately \$2.9 million. Given the relatively small difference between the cost of providing infrastructure and the cost of acquisition as open space, it is possible that the city may decide to add this property to the city's existing Open Space network.

Addition as part of the monument is recommended only as part of alternative 2.

Cohen Property, No Action under Any Alternatives

This 2.21-acre property, within the monument, contains a single-family residence, swimming pool, a sweat lodge, a Buddhist prayer wheel, a stupa (shrine), and storage outbuildings. The property owners requested a boundary adjustment to exclude their property from the monument. The approved *Land Protection Plan* (National Park Service and City of

Albuquerque 1991) recommends the fee simple acquisition of this property and the removal of structures to restore the undeveloped character of the escarpment. Since the approval of the *Land Protection Plan* the federal government has acquired adjacent structures and converted two

of them to the interim visitor center and staff offices. Once these NPS facilities are no longer in use and are removed from the site, the structures on the boundary adjustment area would be a visual intrusion. It is recommended that a boundary adjustment not be made.

APPENDIX K: FEE DETERMINATION

The Land and Water Conservation Fund Act, as amended, provides for establishing fees within units of the national park system. Three specific types of fees are covered under the act — entrance fees, daily recreation use fees, and special recreation permit fees. The act outlines six criteria for determining if an area, facility, or service will be designated for fees. It is the superintendent's responsibility to apply the criteria and recommend, if appropriate, recreation fees for the park unit. The legislative criteria are as follows:

- **Direct and Indirect Cost to the Government** — This criterion is used to determine the government's cost of establishing and maintaining a fee collection program including direct costs — salaries, equipment (registers, safes, lock boxes), transportation, supplies (forms, tickets, register tapes), facility maintenance, and any capital improvements (entrance booths, roads, etc.), and indirect costs — primarily overhead expenses including administrative staff time to manage the fee program.
- **Benefit to the Recipient** — Generally, this is a yes/no answer. If visitors benefit from the program, service, or activity, then a fee should be considered.
- **Comparability** — If a fee is charged, it is NPS policy that fees will be set at a level that will not create unfair competition with private facilities.
- **Economic and Administrative Feasibility of Fee Collection** — Fee collection is considered feasible if the collection method is workable and cost-effective. Variables to consider include visitation level, effect of fees on visitation, number of visitor access points, ease of collection and enforcement, availability of staff, and overall revenue potential.
- **Public Policy or Interest Served** — The act established federal policy, which says that people taking advantage of facilities/ services should pay a greater share of the associated operating charges than the public as a whole. In weighing this policy, it needs to be kept in mind that the National Park Service is committed to ensuring that a full spectrum of park visitors have access to park experiences.
- **Other Pertinent Factors** — These include considering whether other park purposes are served by establishing a fee program (i.e., increased visitor contact, reduction of crime, etc.)

APPENDIX L: VISITOR CENTER SITE SELECTION CRITERIA AND ANALYSIS

The visitor center represents the focal point for visitor facilities at Petroglyph National Monument. This facility provides visitors with orientation to all of the monument's resources and a basic understanding of the petroglyphs, their meaning, and their setting as well as providing other services such as restrooms. Ideally, all visitors would come to the visitor center early in their visit to the monument to have a basic understanding of the resources and enhance their experiences. After visiting the center, visitors should also have easy access to the monument's resources. In this manner the visitor center and the monument's resources become cohesive parts of visitors' experiences. The challenge of locating the visitor center to meet this ideal goal is to select a site that provides the ease of access while also balancing the needs for protecting the sensitive resources. To accomplish this objective a systematic approach was employed to evaluate sites with the greatest development potential within the monument and select a site based on a careful consideration of its attributes.

The first step in this process was to identify the criteria for selecting an appropriate development site. The following criteria were developed:

1. Accessible to a major street — This aspect is important for visitors as well as for reducing development costs of new road construction. A major street would also handle increased traffic flows from visitors to the monument.
2. Easy Access to I-40 — Less than 1/2 mile from the southern end of the monument, I-40 is the closest interstate to the monument. Proximity to this highway would allow visitors the opportunity to visit a national monument easily and with minimal traffic conflicts.
3. Access to other portions of the monument — Because the monument is in the midst of suburban development with relatively small land base, access from one part to another relies on existing city streets. There must be clear and direct routes for visitors to travel to various portions of the monument with a minimum of conflicts with area residents.
4. Proximity to escarpment with petroglyphs — Convenience and ease of access to petroglyphs would provide visitors with a minimum of intrusions to seeing the primary monument resources. A direct, relatively short path from the visitor center allows visitors to focus on information gained in the centers and enables a better appreciation of the petroglyphs.
5. Site with dramatic setting — Many areas within the monument offer dramatic views of the Sandia Mountains, the escarpment, the Rio Grande Valley, and the city. These views not only enhance the aesthetic experiences of visitors but also provide an appropriate context for the petroglyph cultural landscape.
6. Minimal intrusions — Because the monument is near rapidly developing edges of Albuquerque, there are many adjacent land uses that detract from the natural scenery of the monument lands. Although it may be impossible to locate the visitor center completely away from the urban and suburban incursions, appropriate site selection and facility orientation can reduce the negative impacts on visitor experiences.
7. Access to utilities — While avoiding development for aesthetic purposes is appropriate, this should be balanced with practical concerns such as utility access. Public utilities are readily available to many parts of the monument, and locating facilities nearby would result in reducing construction costs and environmental impacts due to construction activities.
8. Suitable soils that avoid slope, drainage, and floodplain constraints — Most of the soils within the monument are suitable for

most types of development. However, appropriate slopes are an important consideration. Sites with slopes no greater than 10% would be appropriate. Also, potential sites should be outside of the 100-year floodplain, with minimal interference of natural drainage patterns.

9. Minimal impacts on vegetation and wildlife and their habitats — A monumentwide vegetation inventory is currently being conducted, which will provide more specific data in the future for development considerations. However, a conservative approach to site selection would be to give greater consideration to sites previously disturbed to reduce the likelihood of negative impacts on the natural environment.
10. Avoid impacts on archeological, cultural, and historical resources.
11. Minimize impacts on existing and future neighborhoods.

SITE IDENTIFICATION

An initial selection of sites was conducted based on the above criteria. Six sites were identified for potential development of monument facilities. All six sites meet all or most of the criteria. In general, they are at the base of the escarpment and close to one of the four major petroglyph concentrations (Mesa Prieta, Rinconada Canyon, Boca Negra Canyon, and Piedras Marcadas Canyon). A site considered but rejected (see "Alternatives Considered But Rejected" section) is close to Piedras Marcadas Canyon. This northern location does not meet the criteria for ease of access to the other parts of the monument.

The six sites, with the site analysis, are

1. **Mesa Prieta.** This site is within a short walking distance to the "elbow" of the canyon and the petroglyphs along the mesa escarpment. In general, it has easy slopes and is somewhat screened from future surrounding development. Access

to the site would be from the proposed 98th Street.

Benefits:

- proximity to I-40
- good southern exposure on 5% and less slopes
- dramatic views to escarpment, city and Sandias/no view to water tank
- existing topography screens majority of future development to retain natural setting of site
- easy access to abundant petroglyphs

Disadvantages:

- future access from 98th street requires cooperation from private landowner, Westland Corporation, and city; uncertain assurance that 98th will be a reality
- future surrounding residential development
- relatively undisturbed land would be impacted by development

2. **Water Tank.** The site is between the Mesa Prieta site and the existing water tank. It is on somewhat steeper northwest-facing slopes and would also be accessed from the proposed 98th Street.

Benefits:

- proximity to I-40
- views to escarpment, city, and Sandias
- access to limited number of petroglyphs
- wide variety of interpretive opportunities on the site

Disadvantages:

- located on north-facing slope of 5-10%
- same access as Mesa Prieta
- views to water tank
- future surrounding residential development would intrude on the natural setting of the site
- relatively undisturbed land

3. **Laurelwood.** This site is near the proposed property acquisition for visitor center development. The privately owned lots are no longer feasible for acquisition; however, a potential development site is

available within the authorized monument boundary. It would be accessed from the proposed Lava Bluffs Street.

Benefits:

- proximity to I-40
- located on 2-5% slopes
- views to Sandias and escarpment

Disadvantages:

- access to limited petroglyphs
- some disturbed land
- future access from residential development
- surrounding residential development

4. **Rinconada.** This site is at the mouth of the canyon on the northern portion of the site. It is accessed directly from Unser Road. The site has been somewhat disturbed and offers ready access to abundant petroglyphs.

Benefits:

- proximity to I-40
- located on northeast-facing 2-5% slopes
- access to abundant petroglyphs
- disturbed land for development
- views to Sandias and escarpment
- easy access from Unser

Disadvantages:

- overhead power lines across site may be harmful to health and detract from views
- sensitive site

5. **Lava Shadows.** This site is also accessed directly from Unser Road on a significantly disturbed site. Although the site does not offer immediate access to petroglyphs, there are a limited number of petroglyphs available on a 15-18 minute hike. There are also opportunities for some excellent views of Albuquerque from the top of the Aberlee road cut.

Benefits:

- central location
- good exposure on southeast-facing 5% slopes
- severely disturbed land
- views to Rio Grande, Sandias, city

- access to overlooks
- easy access from Unser

Disadvantages:

- difficult access to minimal petroglyphs
- disturbed escarpment detracts from the petroglyph context

6. **Boca Negra.** This site is at the former state park and currently provides restrooms, interpretive shelters, picnicking, petroglyph viewing trails, and parking.

Benefits:

- located on level 2-3% slopes
- access to abundant petroglyphs
- previously developed land
- views to escarpment, Rio Grande, Sandias, Albuquerque
- access to overlooks
- easy access to Atrisco/Unser

Disadvantages:

- distance from I-40
- existing drainage constraint
- surrounding residential and office development

CONCLUSION

The Boca Negra location appears to have many advantages that make it the most desirable site. Its abundant and good quality petroglyphs provide the best petroglyph viewing opportunities without impacting sensitive landscapes. Although the Mesa Prieta site has a superior natural ambiance, its relatively pristine environment, vulnerable archeological sites, and uncertain future for access make it less desirable. Rinconada Canyon also has excellent petroglyph viewing opportunities; however, it would also impact a sensitive environment. Lava Shadows has the advantage of being highly disturbed but offers inferior petroglyph viewing opportunities. Finally, both the water tank and the Laurelwood sites are not desirable because of their limited size and their future settings would be surrounded by housing developments. The water tank site also has the disadvantage of uncertain access.

BUILDING AND PARKING NEEDS

See appendix I.

SCHEMATIC SITE PLAN DEVELOPMENT

Each potential development area was evaluated by producing schematic site plans. The four primary functions — visitor center, monument administration, petroglyph research center, and heritage education facility, in addition to parking and access — were included in the schematics. In each of the schematics, the maximum level of development appropriate for each site was incorporated. Each of these could

be scaled back to further reduce impacts at the site. In this manner, a preliminary determination of natural and cultural sensitivity was identified and each site was evaluated based on maximum development to determine its suitability. Following the schematic planning, the benefits and disadvantages were identified to further evaluate the desirability of the each area.

FACILITY SIZE AND FUNCTION

See tables I-1 and I-2 in appendix I.

APPENDIX M: ABANDONED SURFACE MINES

There are three abandoned mines within the monument. Mining at site 1 (described below) and site 2 ceased at least 15 years ago, before the city bought the property for an open space park. Mining activity at site 3 continued until the mid 1980s. The main use for the mined cinder and scoria was for road surfacing, decorative rock, stormwater channel armor, and other mineral material uses.

Mine reclamation is the practice of returning disturbed sites to conditions and processes representing the undisturbed ecological zone in which the mining operation lies. Typical activities and goals for reclaiming the cinder mines include (1) reshaping waste rock piles for erosion control and establishing contours that blend with surrounding lands, (2) reducing highwalls to lessen safety hazards, and (3) revegetating the site. All reclamation activities would focus on disturbed areas and minimize intrusion on adjacent lands. A description of the general approaches needed to accelerate the recovery process follows.

Site 1, Southeast Slope of Vulcan Volcano

Fill would be added and then graded to blend the site with the surrounding landscape. (The amount of fill required to minimize the existing steep slopes would be much less than would be required to restore original contours.) Possible sources of fill include sediment from stormwater detention basins within the Albuquerque area and scoria stockpiles from site 2 (above). The material at site 2 is similar in character to that found within site 1. After completion of the rough grading, topsoil materials would be added to provide a better environment for revegetation. The site would be revegetated with native indigenous species.

Site 2, Between the Existing Parking Area and Black Volcano

Site 2 consists of two small pits where material was excavated and pushed into berms on the perimeter. It appears that little material was

removed from the site. Soils were pushed to the side and subsequently buried beneath material from the pits.

The first step would be to regrade the scoria stockpiles to the approximate original contours. Then the topsoil would be replaced, most of which is buried below the unweathered scoria. If some of the scoria is transported to site 1 for backfilling, the weathered materials would be regraded to make the site compatible with the surrounding undisturbed lands. After completion of the rough grading, topsoil would be added to provide a better environment for revegetation. The site would be revegetated with native indigenous species.

Site 3, South of JA Volcano

Site 3 consists of a 125' x 175' x 15' quarry and a 175' x 165' area where fines (fine gravel and smaller material from crushing, sorting, and perhaps washing of scoria) were stockpiled. There are also three stockpiles of well-graded, cobble-sized scoria.

Reclamation plans for this site would be contingent on the final disposal of the piles of scoria onsite that may be removed by the previous owner. If left onsite, the washed/graded scoria material would be extremely difficult to revegetate because of the porous nature of the scoria itself and the uniform grade. One option would be to mix the scoria with fine material, perhaps from the sediment basins mentioned above, as part of the process of backfilling the quarry. It would be important to ensure that most voids are filled to inhibit downward washing of fines (fine gravel and smaller material from crushing, sorting, and perhaps washing of scoria) from the surface. The fines from the washing/sorting operations could be used, but there would not be enough material to regrade the entire site. After completion of the rough grading, topsoil would be added to provide a better environment for revegetation. The site would be revegetated with native indigenous species.

APPENDIX N: STAFFING FOR PROPOSED ACTION

VISITOR SERVICES

Boca Negra Visitor Center — shared NPS/city responsibility

Hours of operation 8 AM to 8 PM — 7 days/week — April to October

8 AM to 5 PM — 7 days/week — Nov. to March

Daily staffing needs 2 permanent employees — year-round

2 seasonal employees — April to October

NPS staffing needs 3 permanent employees

3 seasonal employees — April to October

Total NPS staffing needs = 4.5 FTEs

Total city staffing needs* = 2 FTEs

Piedras Marcadas Ruin Center — (city responsibility)

Hours of operation 9 AM to 5 PM — 7 days/week — year-round

Daily staffing needs 2 permanent employees — year-round

Total city staffing needs* 4 permanent employees — year-round
= 4 FTEs

Piedras Marcadas Canyon Visitor Contact Station — (city responsibility)

Hours of operation 9 AM to 5 PM — 7 days/week — year-round
facility functions staffed or unstaffed

Daily staffing needs 1 permanent employee, year-round

1 permanent employee

Total city staffing needs* = 1 FTE

Rinconada Canyon Visitor Contact Station — (NPS responsibility)

Hours of operation 9 AM to 5 PM — 7 days/week — year-round
facility functions staffed or unstaffed

Daily staffing needs 1 permanent employee - year-round

1 permanent employee

Total NPS staffing needs = 1 FTE

Guided Interpretive Tours/Roving Assignments — (shared NPS/city responsibility)

Hours of service 9 AM to 8 PM — 7 days/week — April to October

9 AM to 5 PM — 7 days/week — November to March

Daily staffing needs 2 permanent employees — year-round

1 seasonal employee — April to October

Total NPS staffing needs 3 permanent employees

1 seasonal employee — April to October

= 3.5 FTEs

Total city staffing needs* = 1 FTE

Heritage Education Center — (NPS responsibility)

Hours of operation 8 AM to 5 PM — 5 days/week — year-round

Daily staffing needs 1 clerical assistant

4 permanent employees (rangers)

Total NPS staffing needs 5 permanent employees

= 5 FTEs

Visitor Services Management/Administration

Staffing needs	1 division chief (NPS Only)
	1 community outreach coordinator
	1 clerical assistant
Total NPS staffing needs	= 3 FTEs
City staffing needs	1 section head
	1 assistant
Total city staffing needs*	= 2 FTEs

MAINTENANCE OPERATIONS

Workload	10,000 sq. ft. Boca Negra Canyon Visitor Center (NPS and city)
	6,000 sq. ft. Heritage Education Center (NPS)
	13,000 sq. ft. Administration/Research Center/Maintenance Complex (NPS)
	3,000 sq. ft. Piedras Marcadas Ruin Visitor Contact Station (City)
	1,500 sq. ft. Piedras Marcadas Visitor Contact Station (City)
	1,500 sq. ft. Rinconada Canyon Visitor Contact Station (NPS)
	35 miles of trail (NPS and city)
	trash collection monumentwide (NPS and city)
	fence, arroyo, parking, trailhead maintenance monumentwide (NPS and city)
NPS staffing needs	1 maintenance manager (NPS only)
	1 clerical assistant
	4 custodial employees
	4 trails workers
	1 heavy equipment operator
	2 building/facility maintenance employees
Total NPS staffing needs	= 13 FTEs
City staffing needs	1 custodial employee
	2 trails workers
	1 heavy equipment operator
	1 building/facility maintenance employee
Total city staffing needs*	= 5 FTEs

VISITOR AND RESOURCE PROTECTION (NPS and City Responsibility)

Hours of operation	24 hours/day, 365 days/year
Scope of operation	1-2 rangers roving/vehicle patrol — all times
	2 rangers on foot patrol — visitor hours
Total NPS staffing needs	2 permanent visitor protection supervisors (NPS only)
	1 permanent clerical assistant
	8 permanent visitor protection rangers
	1 permit coordinator/protection specialist
	= 12 FTEs
Total city staffing needs*	1 sergeant
	3 rangers
	1 clerical/dispatcher
	= 5 FTEs

RESOURCE MANAGEMENT (NPS and City Responsibility)

Total NPS staffing needs 1 natural resources manager
1 natural resources technician
1 cultural resources manager
1 archeologist
1 part-time museum curator
= 4.5 FTEs

Total city staffing needs* 1 natural resources planner
1 natural resources technician
= 2 FTEs

PETROGLYPH RESEARCH CENTER (NPS Responsibility)

Total NPS staffing needs 1 center director
1 librarian/archivist/data manager
1 petroglyph conservator
1 petroglyph research coordinator
1 clerical assistant
= 5 FTEs

MONUMENT MANAGEMENT/ADMINISTRATION (NPS and City Responsibility)

Total NPS staffing needs 1 monument manager
1 administrative officer
1 purchasing agent/contracting officer
1 personnel assistant
2 clerical employees
= 6 FTEs

Total city staffing needs* 1 monument manager
1 administrative assistant
1 clerical assistant
= 3 FTEs

TOTAL NPS NEEDS = 57.5 FTEs

TOTAL CITY NEEDS = 25 FTEs*

* Provided by city Open Space Division

APPENDIX O: PROJECTED VISITOR USE

THE PROCESS

Located as it is, on the west side of New Mexico's largest city, the monument has excellent potential of becoming one of the area's major visitor attractions. A significant percent of monument visitation will come from the local area because of its proximity to the large urban population of the greater Albuquerque area. Out-of-state visitation will grow as the monument becomes better known throughout the country. Access to the monument via the interstate highway system is excellent. The monument is less than 1 mile north of I-40 and about 6 miles west of I-25.

Another factor affecting the amount and type of visitor use the monument has is the level and type of visitor-related development. A park with a relatively high level of developed infrastructure (visitor center, parking areas, roads, etc.) and visitor services (interpretation, guided tours, etc.) would encourage higher levels of visitor use than one that offers minimal development and limited visitor services.

Monument visitation has grown in recent years (see "Visitor Use Statistics and Analysis" section). A period of rapid growth would be expected as visitor-related facilities are developed and the facilities become known to the public.

A user market analysis of the monument was done by the Socioeconomic Studies Division of the National Park Service. This study examined activity participation rates, population sizes, driving times, and visitor demographics.

Three general markets are identified for most units within the national park system: regional domestic, national domestic, and foreign. Potential proportions from these markets were estimated based on user surveys conducted at four nearby parks with some similar characteristics as the monument — Bandelier National Monument, Chaco Culture National Historical Park, Wupatki National Monument, and Mesa Verde National Park. These surveys

determined that the market shares (the percentage of the potential market that visited a particular park) ranged from 7.78% to 50.28%. The average for the four parks was 28.12%.

In determining the user market potential, most emphasis was placed on the regional market. A population analysis of the nine-state region — containing over 2,000 zip code areas — was conducted. Forty-four groups of similar neighborhoods were identified based on socioeconomic and demographic attributes. Using participation rates, the zip code areas were matched with the 44 market segments to determine the potential user market within the regional area. These zip code areas represent the areas with the shortest drive times to the monument. It was determined that the average drive time within the regional market area is 4.41 hours. In 1990 this drive time equated to a potential regional market of approximately 312,600 persons.

Combining all three markets and using this market segmentation method to project the level of visitor use for Petroglyph National Monument for 1990 resulted in a figure of 60,000 projected visits. Actual visitor use of the Boca Negra unit (actually the Indian Petroglyph State Park) amounted to over 48,000 visits in 1990 (see table 11 in "Affected Environment" section). This use, plus the unrecorded use of the rest of the monument area, is probably very near the projected figure of 60,000 visits.

Based on the U.S. Census projections of the 44 market segment populations, the full potential for the Petroglyph National Monument region in the year 2010 will be about 1,045,684 visits. This figure and the lowest market share, 7.78%, was used to project a conservative forecast of future visitor use of the monument. A 7.78% market share was the lowest, and it is therefore the most conservative. Conservative visitor projections are called for because they are the most easily achieved and there is no reliable information upon which to base or support higher projections.

To determine the projected monument visitation, full potential of 1,045,684 visits was multiplied by the regional market share of 7.78%. This result was 81,356 visits. Prior analysis showed that this figure was 32.65% of the total domestic market. Visitors from outside the region accounted for 67.35% of the total domestic market (167,820 visits). The foreign market (33,703 visits) was an additional 11.92% of the total domestic market. These figures were then combined to determine the total potential visits (282,879 visits).

Based upon these analyses, it is projected that by the year 2000 Petroglyph National Monument should expect to accommodate about 189,000 visits. By the year 2010, nearly 283,000 visits are projected for the monument. These figures are conservative. Based on the recorded use of the monument in the last couple of years and the comparison of the expected and actual use in 1990, these are reasonable projections.

THE PROJECTIONS

It is not possible to accurately predict a pattern of use for the monument from only two years' data and the fact that there may be significant changes to visitor facilities and because of the number and nature of variables that affect visitation. These variables include national and international economic conditions that can affect family income that affects travel and tourism patterns, visitor facilities that could be visitor attractions such as a visitor center with a dynamic and popular multimedia presentation, and the ability of the region to attract tourists to related sites. Many other factors can also influence visitation. However, it is certain that reported visitation to the monument will increase once the monument is developed and facilities are fully functioning.

Visitation studies conducted in the mid 1980s before establishment of the monument projected monument visitation to range from 210,000 to 400,000 visitors per year. These studies used visitation to the Indian Petroglyph State Park, Albuquerque region visitation levels, and visitation to other federal and state parks and monuments as the basis for projections.

To better understand potential visitor impacts, a study of projected visitation, using a user market analysis, was conducted by the NPS Socioeconomic Studies Division. This study examined activity participation rates, population sizes, distance, and visitor demographics.

The study estimated that there would be about 189,000 annual visits to the monument by the year 2,000 and that there would be 283,000 annual visits by the year 2,010. These estimates assume that visitor facilities would be developed as recommended in the proposed action (alternative 1). These visitation projections are intended for use in impact assessment only. They cannot be considered as desired or optimum levels or goals for future use.

These projections can be put in perspective by comparisons with other national park system areas such as Bandelier, Pecos, and El Moro National Monuments in New Mexico and Saguaro, Walnut Canyon, and Wupatki National Monuments and Petrified Forest National Park in Arizona (see table below).

Each of these national park system areas have community, accessibility, and resource differences from Petroglyph National Monument. However, using 1990 and 1994 visitor levels, some comparisons can be made on the potential future visitation for Petroglyph National Monument.

**TABLE O-1. VISITS TO NATIONAL PARK UNITS IN NEW MEXICO
1988 AND 1992, AND PERCENT OF CHANGE**

PARK	1990 VISITS	1994 VISITS	PERCENT CHANGE 1990 TO 1994
Aztec	80,037	84,345	5%
Bandelier NM	327,918	430,138	31%
Canyon De Chelly NM	642,189	767,368	19%
Capulin Volcano NM	53,857	54,403	1%
Carlsbad Caverns NP	747,016	617,087	-17%
Chaco Culture NHP	72,675	76,173	5%
El Malpais NM	78,993	101,492	28%
El Morro NM	69,343	87,548	26%
Fort Union NM	17,031	20,301	19%
Gila Cliff Dwellings NM	52,316	59,693	14%
Grand Canyon NM	3,776,685	4,364,316	16%
Hubble Trading Post NHS	180,923	237,013	31%
Navajo NM	76,808	105,234	37%
Pecos NHP	45,316	39,517	-13%
Petrified Forest NP	844,582	922,927	9%
Petroglyph NM	48,403	88,059	82%
Saguaro NM	702,328	768,685	9%
Salinas Pueblo Missions NM	36,313	51,391	42%
Sunset Crater NM	502,450	522,963	4%
Walnut Canyon NM	134,429	162,295	21%
White Sands NM	582,487	583,061	1%
Wupatki NM	249,954	264,747	6%

SOURCE: National Park Service, Washington Office, Socioeconomic Studies Division

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